INTRODUCTORY

MAXIM

High Voltage, Fault-Protected Analog Multiplexers

MAX378/379

General Description

Maxim's MAX378 is an 8 channel single-ended (1 of 8) multiplexer with fault protection, and the MAX379 is a 4 channel differential (2 of 8) multiplexer with fault protection. Using a series N-channel, P-channel, N-channel structure, these multiplexers provide significant fault protection. If the power supplies to the fault-protected multiplexers are inadvertently turned off while input voltages are still applied, *all* channels in the multiplexers are turned off, and only a few nanoamperes of leakage current will flow into the inputs. This protects not only the multiplexers and the circuitry driven by the multiplexers, but also protects the sensors or signal sources which drive the multiplexers.

The series N-channel, P-channel, N-channel protection structure has two significant advantages over the simple current limiting protection scheme of the industry's first generation fault-protected multiplexers. First, the Maxim protection scheme limits fault currents to nanoamp leakage values rather than many milliamperes. This prevents damage to sensors or other sensitive signal sources. Second, the MAX378/379 fault-protected multiplexers can withstand a *continuous* ±60V input, unlike the first generation which had a continuous ±35V input limitation imposed by power dissipation considerations.

All digital inputs have logic thresholds of 0.8V and 2.4V, ensuring both TTL and CMOS compatibility without requiring pullup resistors. Break-before-make operation is guaranteed. Power dissipation is less than 2 milliwatts.

Applications

Data Acquisition Systems

Industrial and Process Control Systems

Avionics Test Equipment

Signal routing between Systems

Features

- ◆ **Fault Input Voltage ±75V with Power Supplies Off**
- ◆ **Fault Input Voltage ±60V with ±15V Power Supplies**
- ◆ **All Switches Off with Power Supplies Off**
- ◆ **On Channel Turns OFF if Overvoltage Occurs on Input or Output**
- ◆ **Only Nanoamperes of Input Current Under All Fault Conditions**
- ◆ **No Increase in Supply Currents Due to Fault Conditions**
- ◆ **Latchup-proof Construction**
- ◆ **Operates From ±4.5V to ±18V Supplies**
- ◆ **All Digital Inputs are TTL and CMOS Compatible**
- ◆ **Low-Power Monolithic CMOS Design**

Ordering Information

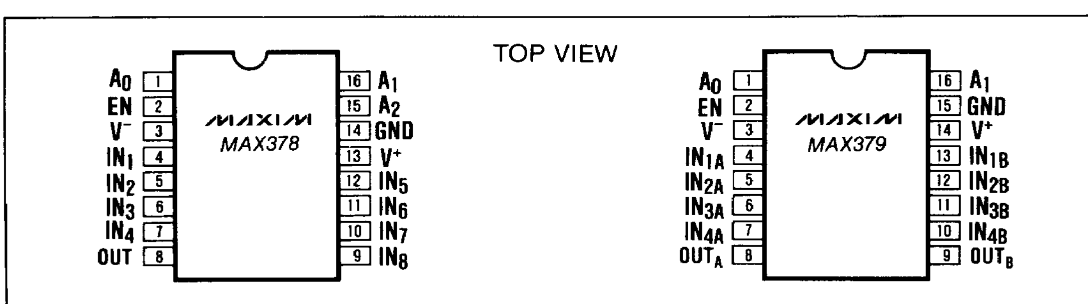
PART	TEMP. RANGE	PACKAGE
MAX378CPE	0°C to +70°C	16 Lead Plastic DIP
MAX378CWE	0°C to +70°C	16 Lead Wide SO
MAX378CJE	0°C to +70°C	16 Lead CERDIP
MAX378EPE	-40°C to +85°C	16 Lead Plastic DIP
MAX378EWE	-40°C to +85°C	16 Lead Wide SO
MAX378EJE	-40°C to +85°C	16 Lead CERDIP
MAX378MJE	-55°C to +125°C	16 Lead CERDIP
MAX378MLP*	-55°C to +125°C	20 Lead LCC
MAX378C/D**	0°C to +70°C	Dice
MAX379CPE	0°C to +70°C	16 Lead Plastic DIP
MAX379CWE	0°C to +70°C	16 Lead Wide SO
MAX379CJE	0°C to +70°C	16 Lead CERDIP

Ordering Information continued on page 10.

* Contact Factory for availability.

** The substrate may be allowed to float or be tied to V+ (JI CMOS).

Pin Configurations



High Voltage, Fault-Protected Analog Multiplexers

ABSOLUTE MAXIMUM RATINGS

Voltage between Supply Pins .... +44V
V^+ to Ground .... +22V
V^- to Ground .... -22V
Digital Input Overvoltage:
V_{EN}, V_A { V^+ .... +4V
{ V^- .... -4V
Analog Input with Multiplexer Power On .... ±65V
{ Recommended } V^+ .... +15V
{ Power Supplies } V^- .... -15V
Analog Input with Multiplexer Power Off .... ±80V

Continuous Current, IN or OUT 20mA
Peak Current, IN or OUT
(Pulsed at 1ms, 10% duty cycle max) 40mA
Power Dissipation (Note 1) (CERDIP) 1.28W
Operating Temperature Range:
MAX378/379M .... -55°C to +125°C
MAX378/379C .... 0°C to +70°C
MAX378/379E .... -40°C to +85°C
Storage Temperature Range .... -65°C to +150°C

Note 1: Derate 12.8mW/°C above T_A = +75°C

Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions above those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS

(V^+ = +15V, V^- = -15V; V_{AH} (Logic Level High) = +2.4V, V_{AL} (Logic Level Low) = +0.8V unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	-55°C to +125°C MIN	TYP	MAX	0°C to +70°C and -40°C to +85°C MIN	TYP	MAX	UNITS
STATIC										
ON Resistance	$r_{DS(ON)}$	V_{OUT} = ±10V, I_{IN} = 100μA V_{AL} = 0.8V, V_{AH} = 2.4V	+25°C Full		2.0 3.0	3.0 4.0		2.0 3.0	3.5 4.0	kΩ
OFF Input Leakage Current	$I_{IN(OFF)}$	V_{IN} = ± 10V, V_{OUT} = ∓10V V_{EN} = 0.8V (Note 6)	+25°C Full	-0.5 -50	0.03	0.5 50	-1.0 -50	0.03	1.0 50	nA
OFF Output Leakage Current	$I_{OUT(OFF)}$	V_{OUT} = ±10V, V_{IN} = ∓10V V_{EN} = 0.8V MAX378 (Note 6) MAX379	+25°C Full Full	-1.0 -200 -100	0.1	1.0 200 100	-2.0 -200 -100	0.1	2.0 200 100	nA
ON Channel Leakage Current	$I_{OUT(ON)}$	$V_{IN(ALL)}$ = V_{OUT} = ±10V (Note 5) V_{AH} = V_{EN} = 2.4V MAX378 V_{AL} = 0.8V MAX379	+25°C Full Full	-2.0 -200 -100	0.1	2.0 200 100	-5.0 -200 -100	0.1	5.0 200 100	nA
Analog Signal Range	V_{AN}	(Note 2)	Full	-15		+15	-15		+15	V
Differential, OFF Output Leakage Current	I_{DIFF}	MAX379 only (Note 6)	Full	-50		50	-50		50	nA
FAULT										
Output Leakage Current (with Input Overvoltage)	$I_{OUT(OFF)}$	V_{OUT} = 0V (Note 3) V_{IN} = ±60V	+25°C Full		20	 10		20	 20	nA μA
Input Leakage Current (with Overvoltage)	$I_{IN(OFF)}$	V_{IN} = ±60V, V_O = ±10V (Note 3)	+25°C			25			40	μA
Input Leakage Current (with Power Supplies Off)	$I_{IN(OFF)}$	V_{IN} = ±75V, V_{EN} = V_O = 0V A_0 = A_1 = A_2 = 0V or 5V	+25°C			10			20	μA
CONTROL										
Input Low Threshold	V_{AL}	(Note 4)	Full			0.8			0.8	V
Input High Threshold	V_{AH}	(Note 4)	Full	2.4			2.4			V
Input Leakage Current (High or Low)	I_A	V_A = 5V or 0V (Note 5)	Full	-1.0		1.0	-1.0		1.0	μA

ELECTRICAL CHARACTERISTICS (Continued)

(V^+ = +15V, V^- = -15V; V_{AH} (Logic Level High) = +2.4V, V_{AL} (Logic Level Low) = +0.8V unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	-55°C to +125°C			0°C to +70°C and -40°C to +85°C			UNITS
				MIN	TYP	MAX	MIN	TYP	MAX	
DYNAMIC										
Access Time	t_A	(Figure 1)	+25°C		0.5	1.0		0.5	1.0	µs
Break-Before-Make Delay (Figure 2)	t_{ON}-t_{OFF}	V_{EN} = +5V, V_{IN} = ±10V A_0, A_1, A_2 Strobed	+25°C	25	200		25	200		ns
Enable Delay (ON)	$t_{ON(EN)}$	(Figure 3)	+25°C Full		400	750 1000		400	1000 1500	ns
Enable Delay (OFF)	$t_{OFF(EN)}$	(Figure 3)	+25°C Full		300	500 1000		300	 1000	ns
Settling Time (0.1%) (0.01%)	t_{SETT}		+25°C		1.2 3.5			1.2 3.5		µs
"OFF Isolation"	$OFF_{(ISO)}$	V_{EN} = 0.8V, R_L = 1kΩ, C_L = 15pF, V = 7V_{RMS}, f = 100kHz	+25°C	50	68		50	68		dB
Channel Input Capacitance	$C_{IN(OFF)}$		+25°C		5			5		pF
Channel Output Capacitance	$C_{OUT(OFF)}$	MAX378 MAX379	+25°C		25 12			25 12		pF
Digital Input Capacitance	C_A		+25°C		5			5		pF
Input to Output Capacitance	$C_{DS(OFF)}$		+25°C		0.1			0.1		pF
SUPPLY										
Positive Supply Current	I^+	V_{EN} = 0.8V, or 2.4V All V_A = 0V or 5V	+25°C Full		0.1 0.3	0.6 0.7		0.2 0.5	1.0 1.0	mA
Negative Supply Current	I^-	V_{EN} = 0.8V or 2.4V All V_A = 0V or 5V	+25°C Full		0.01 0.02	0.1 0.2		0.01 0.02	0.1 0.1	mA
Power Supply Range for Continuous Operation	V_{OP}	(Note 7)	+25°C	±4.5		±18	±4.5		±18	V

Note 2: When the analog signal exceeds +13.5V or −12V the blocking action of Maxim's gate structure goes into operation. Only leakage currents flow and the channel on resistance rises to infinity.
Note 3: The value shown is the steady state value. The transient leakage is typically 50µA. See detailed description.
Note 4: Guaranteed by other static parameters.
Note 5: Digital input leakage is primarily due to the clamp diodes. Typical leakage is less than 1nA at +25°C.
Note 6: Leakage currents not tested at T_A = cold temp.
Note 7: Electrical characteristics, such as ON Resistance, will change when power supplies other than ±15V are used.

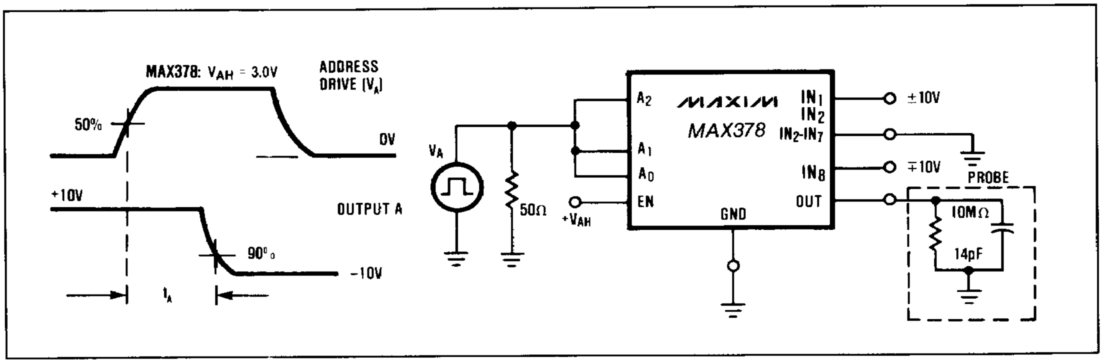


Figure 1. Access Time vs. Lgoic Level (High)

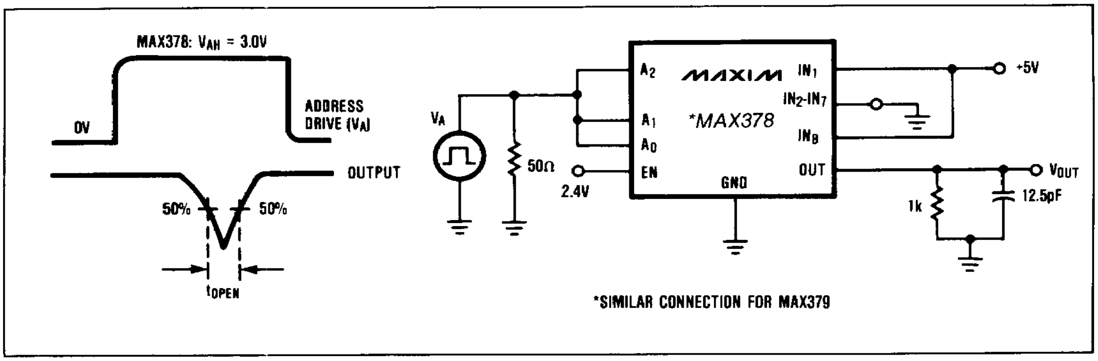


Figure 2. Break-Before-Make Delay (t_{OPEN})

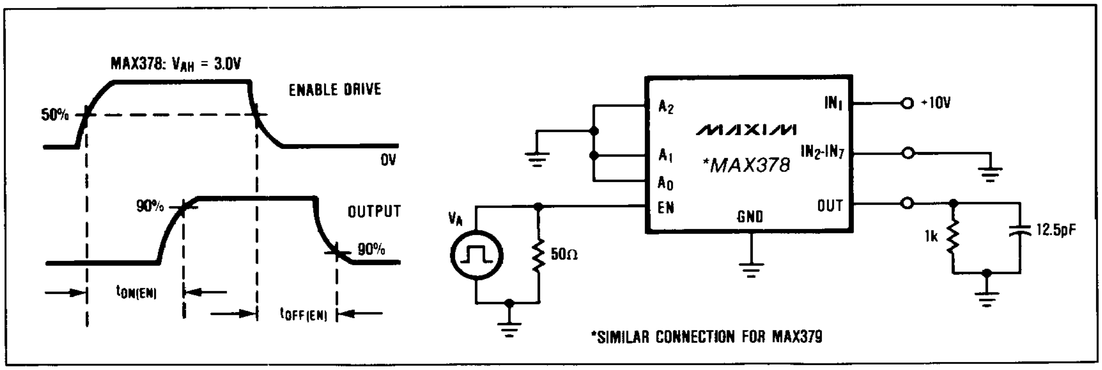


Figure 3. Enable Delay ($t_{ON(EN)}$, $t_{OFF(EN)}$)

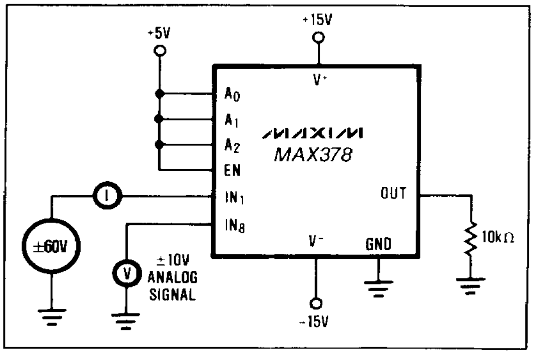


Figure 4. Input Leakage Current (Overvoltage)

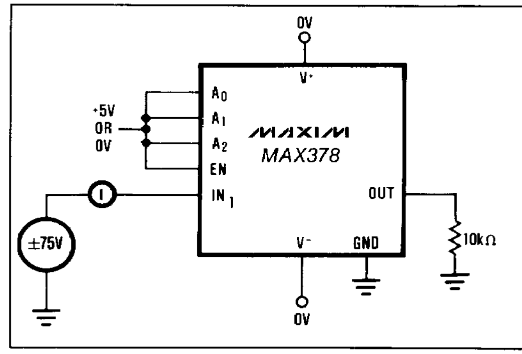
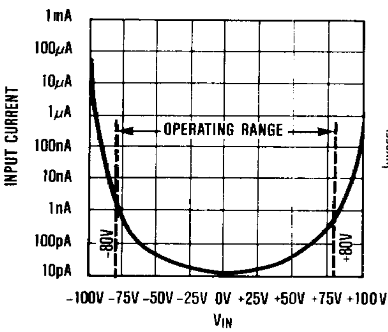


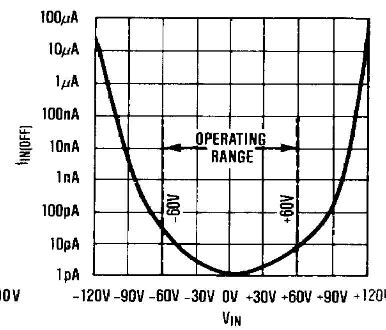
Figure 5. Input Leakage Current (with Power Supplies OFF)

Typical Operating Characteristics

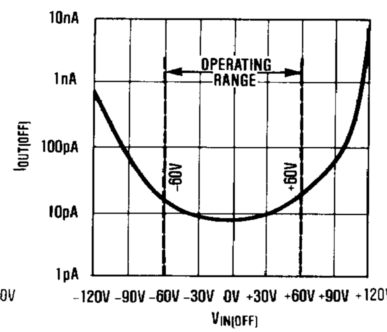
INPUT LEAKAGE vs INPUT VOLTAGE WITH $V^+ = V^- = 0V$



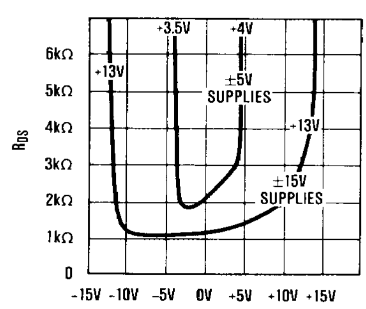
OFF CHANNEL LEAKAGE CURRENT vs INPUT VOLTAGE WITH ±15V SUPPLIES



OUTPUT LEAKAGE vs OFF CHANNEL OVERVOLTAGE WITH ±15V SUPPLIES



$R_{DS(ON)}$ vs ANALOG INPUT VOLTAGE



NOTE: Typical $R_{DS(ON)}$ match @ +10V Analog in (±15V supplies) = 2% for lowest to highest $R_{DS(ON)}$ channel; @ -10V Analog in, match = 3%.

High Voltage, Fault-Protected Analog Multiplexers

TRUTH TABLE—MAX378

A_2	A_1	A_0	EN	ON SWITCH
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

TRUTH TABLE—MAX379

A_1	A_0	EN	ON SWITCH
X	X	0	NONE
0	0	1	1
0	1	1	2
1	0	1	3
1	1	1	4

Note: Logic "0" = $V_{AL} \leq 0.8V$, Logic "1" = $V_{AH} \geq 2.4V$

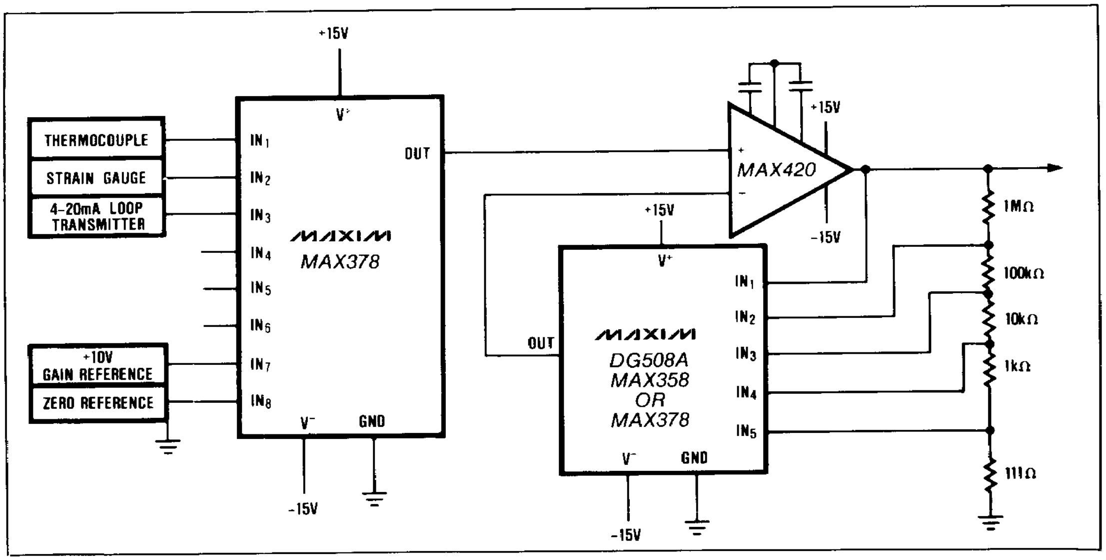


Figure 6. Typical Data Acquisition Front End

Typical Applications

Figure 6 shows a typical data acquisition system using the MAX378 multiplexer. Since the multiplexer is driving a high impedance input, its error is a function of its own resistance ($R_{DS(ON)}$) times the multiplexer leakage current ($I_{OUT(ON)}$) and the ampliifer bias current (I_{BIAS}):

$$V_{ERR} = R_{DS(ON)} \times (I_{OUT(ON)} + I_{BIAS}\ (MAX420))$$
$$= 2.0k \times (2nA + 30pA)$$
$$= 18.0\mu V \text{ maximum error}$$

In most cases, this error is low enough that preamplification of input signals is not needed, even with very low level signals, such as 40μV/°C from type J thermocouples.

In systems with fewer than 8 inputs, an unused channel can be connected to the system ground reference point for software zero correction. A second channel connected to the system voltage reference allows gain correction of the entire data acquisition system as well.

A MAX420 precision op amp is connected as a programmable gain amplifier, with gains ranging from 1 to 10,000. The guaranteed 5μV unadjusted offset of the MAX420 maintains high signal accuracy, while programmable gain allows the output signal level to be scaled to the optimum range for the remainder of the data acquisition system, normally a Sample/Hold and A/D. Since the gain-changing multiplexer is not connected to the external sensors, it can be either a DG508A multiplexer or the fault protected MAX358 or MAX378.

Input switching, however, must be done with a fault-protected MAX378 multiplexer to provide the level of protection and isolation required with most data acquisition inputs. Since external signal sources may continue to supply voltage when the multiplexer and system power are turned off, non-fault protected multiplexers, or even first-generation fault protected devices, will allow many milliamps of fault current to flow from outside sources into the multiplexer. The result could be damage to either the sensors or the multiplexer. A non-fault protected multiplexer will also allow input overvoltages to appear at its output, perhaps damaging Sample/Holds or A/Ds. Such input overdrives may also cause input-to-input shorts, allowing the high current output of one sensor to possibly damage another.

The MAX378 eliminates all of the above problems since it not only limits its output voltage to safe levels, with or without power applied (V^+ and V^-), but also turns all channels off when power is removed, drawing only sub-microamp fault currents from the inputs, and maintaining isolation between inputs for continuous input levels up to ±75V with power supplies off.

Detailed Description

Fault Protection Circuitry

MAX378/379 are fully fault-protected for continuous input voltages up to ±60V, whether or not the V^+ and V^- power supplies are present. These devices use a "series FET" switching scheme which not only protects the multiplexer output from overvoltage, but also limits the input current to sub-microamp levels.

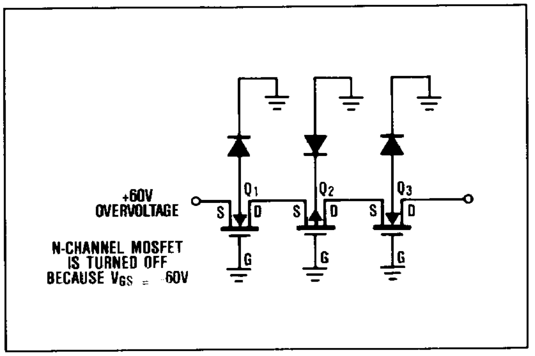


Figure 8. +60V Overvoltage with Multiplexer Power OFF

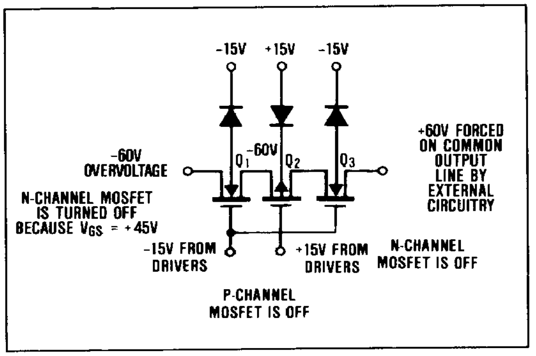


Figure 9. -60V Overvoltage on an OFF Channel with Multiplexer Power Supply ON

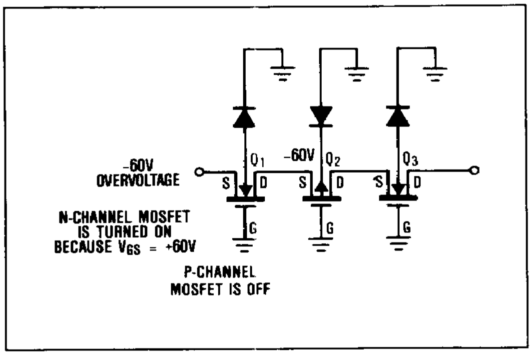


Figure 7. -60V Overvoltage with Multiplexer Power OFF

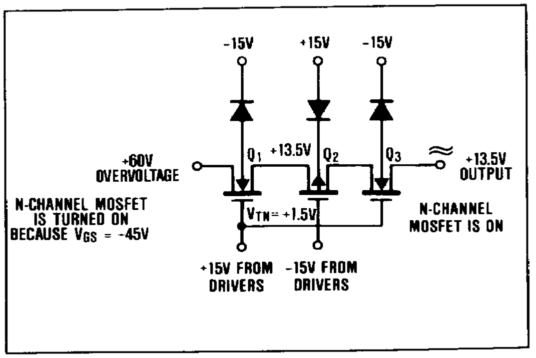


Figure 10. +60V Overvoltage Input to the ON Channel

High Voltage, Fault-Protected Analog Multiplexers

Figures 7 and 8 show how the series FET circuit protects against overvoltage conditions. When power is off, the gates of all three FETs are at ground. With a -60V input, N-channel FET Q1 is turned on by the +60V gate-to-source voltage. The P-channel device (Q2), however, has +60V V_{GS} and is turned off, thereby preventing the input signal from reaching the output. If the input voltage is +60V, Q1 has a negative V_{GS}, which turns it off. Similarly, only sub-microamp leakage currents can flow from the output back to the input, since any voltage will turn off either Q1 or Q2.

Figure 9 shows the condition of an OFF channel with V^+ and V^- present. As with Figures 7 and 8, either an N-channel or a P-channel device will be off for any input voltage from -60V to +60V. The leakage current with negative overvoltages will immediately drop to a few nanoamps at 25°C. For positive overvoltages that fault current will initially be 40 or 50μA, decaying over a few seconds to the nanoamp level. The time constant of this decay is caused by the discharge of stored charge from internal nodes and does not compromise the fault protection scheme.

Figure 10 shows the condition of the ON channel with V^+ and V^- present. With input voltages less than ±10V, all three FETs are on and the input signal appears at the output. If the input voltage exceeds V^+ minus the N-channel threshold voltage (V_{TN}), then the N-channel FET will turn off. For voltages more negative than V^- minus the P-channel threshold (V_{TP}), the P-channel device will turn off. Since V_{TN} is typically 1.5V and V_{TP} is typically 3V, the multiplexer's output swing is limited to about -12V to +13.5V with ±15V supplies.

The Typical Operating Characteristics graphs show typical leakage vs. input voltage curves. Although the maximum rated input of these devices is ±65V, the MAX378/379 typically have excellent performance up to ±75V, providing additional margin for the unknown transients that exist in the real world. In summary, the MAX378/379 provide superior protection from all fault conditions, while using a standard, readily produced junction isolated CMOS process.

Switching Characteristics and Charge Injection

Table 1 shows typical charge injection levels vs. power supply voltages and analog input voltage. Note that since the channels are well matched, the differential charge injection for the MAX379 is typically less than 5 picocoulombs. The charge injection that occurs during switching creates a voltage transient whose magnitude is inversely proportional to the capacitance on the multiplexer output.

The channel-to-channel switching time is typically 600ns, with about 200ns of break-before-make delay. This 200ns break-before-make delay prevents the input-to-input short that would occur if two input channels were simultaneously connected to the output. In a typical data acquisition system such as Figure 6, the dominant delay is not the switching time of the MAX378 multiplexer, but is the settling time of the following amplifiers and S/H. Another limiting factor is the RC time constant of the multiplexer $R_{DS(ON)}$ plus the signal source impedance multiplied by the load capacitance on the output of the multiplexer. Even with low signal source impedances, 100pF of capacitance on the multiplexer output will approximately double the settling time to 0.01% accuracy.

Operation with Supply Voltage Other than ±15V

The main effect of supply voltages other than ±15V is the reduction in output signal range. The MAX378 limits the output voltage to about 1.5V below V^+ and about 3V above V^-. In other words, the output swing is limited to +3.5V to -2V when operating from ±5V. The Typical Operating Characteristics graphs show typical $R_{DS(ON)}$ for ±15V, ±10V, and ±5V power supplies. Maxim tests and guarantees the MAX378/379 for operation from ±4.5V to ±18V supplies. The switching delays are increased by about a factor of 2 at ±5V, but break-before-make action is preserved.

The MAX378/379 can be operated with a single +9V to +22V supply, as well as asymmetrical power supplies such as +15V and -5V. The digital threshold will remain approximately 1.6V above the Ground pin, and the analog characteristics such as $R_{DS(ON)}$ are determined by the total voltage difference between V^+ and V^-. Connect V^- to 0V when operating with a +9V to +22V single supply.

This means that the Maxim MAX378/379 will operate with standard TTL logic levels, even with ±5V power supplies. In all cases, the threshold of the ENable pin is the same as the other logic inputs.

Table 1A. MAX378 Charge Injection

Supply Voltage	Analog Input Level	Injected Charge
±5V	+1.7V 0V -1.7V	+100pC +70pC +45pC
±10V	+5V 0V -5V	+200pC +130pC +60pC
±15V	+10V 0V -10V	+500pC +180pC +50pC

Test Conditions: C_L = 1000pF on multiplexer output; the tabulated analog input level is applied to channel 1; channels 2 through 8 inputs are open circuited. EN = +5V, $A_1 = A_2$ = 0V, A_0 is toggled at 2kHz rate between 0V and 3V. +100 picocoulombs of charge creates a +100mV step when injected into a 1000pF load capacitance.

Table 1B. MAX379 Charge Injection

Supply Voltage	Analog Input Level	Injected Charge Out A	Injected Charge Out B	Injected Charge Differential A-B
±5V	+1.7V	+105pC	+107pC	-2pC
	0V	+73pC	+74pC	-1pC
	-1.7V	+48pC	+50pC	-2pC
±10V	+5V	+215pC	+220pC	-5pC
	0V	+135pC	+139pC	-4pC
	-5V	+62pC	+63pC	-1pC
±15V	+10V	+525pC	+530pC	-5pC
	0V	+180pC	+185pC	-5pC
	-10V	+55pC	+55pC	0pC

Test Conditions: C_L = 1000pF on Out A and Out B; the tabulated analog input level is applied to inputs 1A and 1B; channels 2 through 4 are open circuited. EN = +5V, A_1 = 0V, A_0 is toggled from 0V to 3V at a 2kHz rate.

Digital Interface Levels

The typical digital threshold of both the address lines and the ENable pin is 1.6V, with a temperature coefficient of about -3mV/°C. This ensures compatibility with 0.8V to 2.4V TTL logic swings over the entire temperature range. The digital threshold is relatively independent of the supply voltages, moving from 1.6V typical to 1.5V typical as the power supplies are reduced from ±15V to ±5V. In all cases, the digital threshold is referenced to the Ground pin.

The digital inputs can also be driven with CMOS logic levels swinging from either V^+ to V^- or from V^+ to Ground. The digital input current is just a few nanoamps of leakage at all input voltage levels, with a guaranteed maximum of 1µA. The digital inputs are protected from ESD by a 30V zener diode between the input and V^+, and can be driven ±4V beyond the supplies without drawing excessive current.

Operation as a Demultiplexer

The MAX378/379 will function as a demultiplexer, where the input is applied to the Output pin, and the Input pins are used as outputs. The MAX378/379 provide both break-before-make action and full fault protection when operated as a demultiplexer, unlike earlier generations of fault protected multiplexers.

Channel-to-Channel Crosstalk, Off Isolation and Digital Feedthrough

At DC and low frequencies the channel-to-channel crosstalk is caused by variations in output leakage currents as the off channel input voltages are varied. The MAX378 output leakage varies only a few picoamps as all 7 off inputs are toggled from -10V to +10V. The output voltage change depends on the impedance level at the MAX378 output, which is $R_{DS(ON)}$ plus the input signal source resistance in most cases since the load driven by the MAX378 is usually a high impedance. For a signal source impedance of 10kΩ or lower, the DC crosstalk exceeds 120dB.

Table 2 shows typical AC crosstalk and off isolation performance. Digital feedthrough is masked by the analog charge injection when the output is enabled. When the output is disabled, the digital feedthrough is virtually unmeasurable, since the digital pins are physically isolated from the analog section by the Ground and V^- pins. The groundplane formed by these lines is continued onto the MAX378/9 die to provide over 100dB isolation between the digital and analog sections.

Table 2A. Typical Off Isolation Rejection Ratio

Frequency	100kHz	500kHz	1MHz
One Channel Driven	74dB	72dB	66dB
All Channels Driven	64dB	48dB	44dB

Test Conditions: V_{IN} = $20V_{PK-PK}$ at the tabulated frequency, R_L = 1.5k between OUT and Ground, EN = 0V.

$$\text{OIRR} = 20 \text{ Log } \frac{20V_{PK-PK}}{V_{OUT\ (PK-PK)}}$$

Table 2B. Typical Crosstalk Rejection Ratio

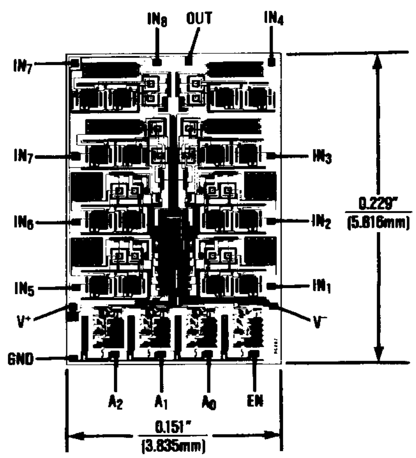
Frequency	100kHz	500kHz	1MHz
F_L = 1.5k	70dB	68dB	64dB
R_L = 10k	62dB	46dB	42dB

Test Conditions: Specified R_L connected from OUT to Ground, EN = +5V, $A_0 = A_1 = A_2$ = +5V (Channel 1 selected). $20V_{PK-PK}$ at the tabulated frequency is applied to Channel 2. All other channels are open circuited. Similar crosstalk rejection can be observed between any two channels.

High Voltage, Fault-Protected Analog Multiplexers

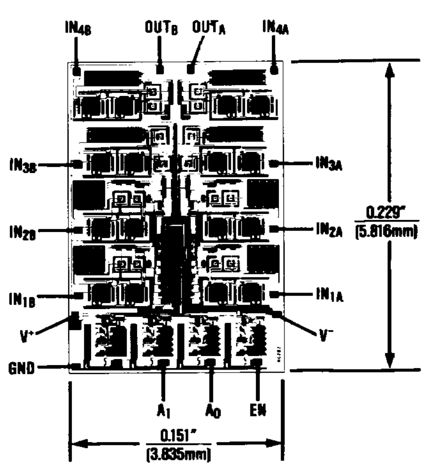
Chip Topographies

MAX378



NOTE: Connect substrate to V+ or leave it floating.

MAX379



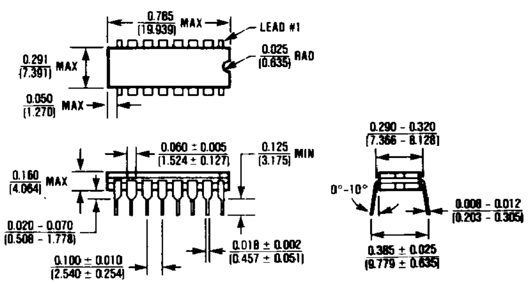
NOTE: Connect substrate to V+ or leave it floating.

Ordering Information (continued)

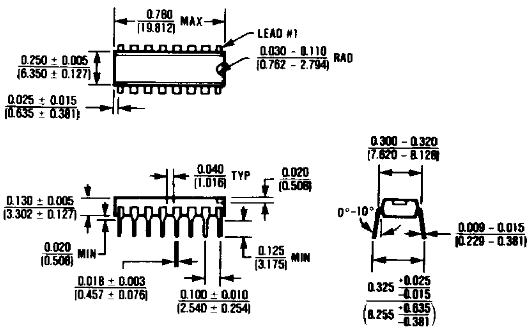
PART	TEMP. RANGE	PACKAGE
MAX379EPE	-40°C to +85°C	16 Lead Plastic DIP
MAX379EWE	-40°C to +85°C	16 Lead Wide SO
MAX379EJE	-40°C to +85°C	16 Lead CERDIP
MAX379MJE	-55°C to +125°C	16 Lead CERDIP
MAX379MLP*	-55°C to +125°C	20 Lead LCC
MAX379C/D**	0°C to +70°C	Dice

* Contact Factory for availability.
** The substrate may be allowed to float or be tied to V+ (JI CMOS).

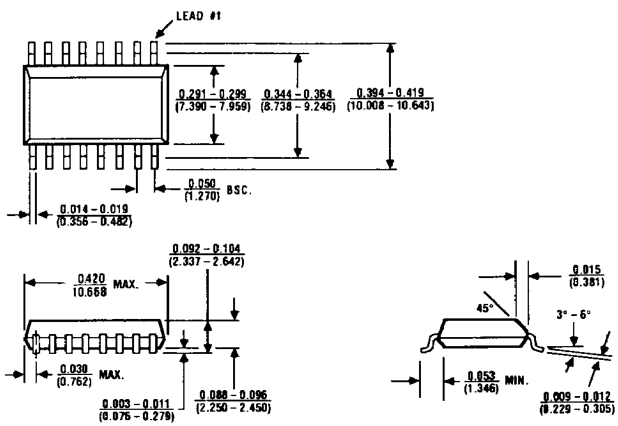
Package Information



16 Lead CERDIP (JE)
θ_{JA} = 100°C/W
θ_{JC} = 50°C/W



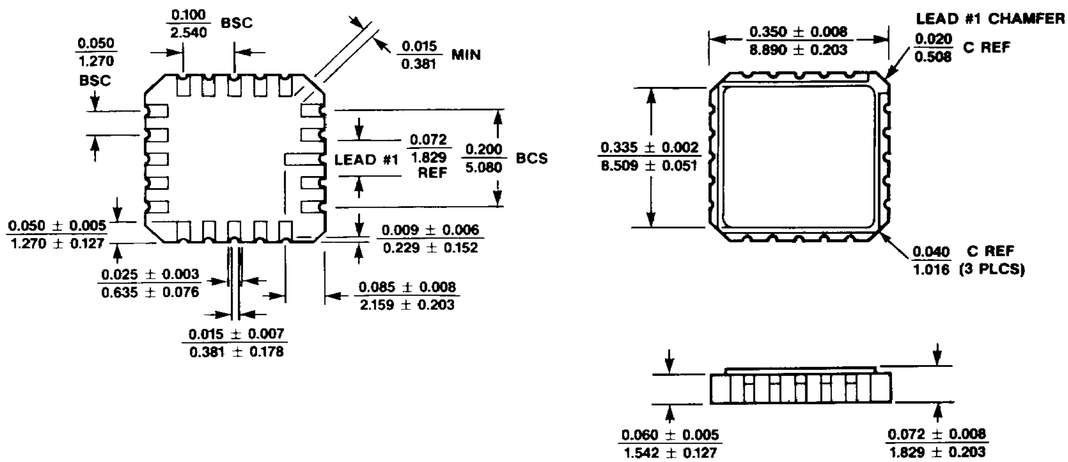
16 Lead Plastic DIP (PE)
θ_{JA} = 135°C/W
θ_{JC} = 65°C/W



16 Lead Small Outline, Wide (WE)
θ_{JA} = 105°C/W
θ_{JC} = 60° C/W

High Voltage, Fault-Protected Analog Multiplexers

Package Information (continued)



20 Leadless Chip Carrier (LP)

θ_{JA} = 140°C/W

θ_{JC} = 45°C/W

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