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 CERDIP 16-PIN	PACKAGE PLASTIC 16-PIN	PACKAGE LCC 20-CONTACT	OPERATING TEMPERATURE RANGE
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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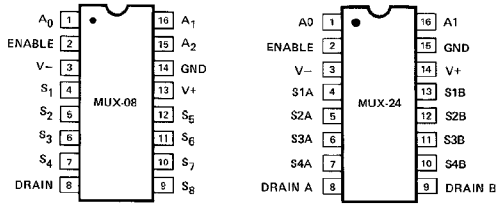
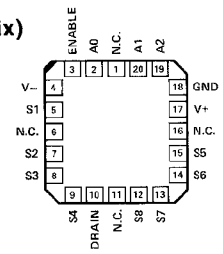
Fabricated with Precision Monolithics' high performance Bipolar-JFET technology, these devices offer low, constant "ON" resistance, low leakage currents and fast settling time with low crosstalk to satisfy a wide variety of applications. These multiplexers do not suffer from latch-up or static charge 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



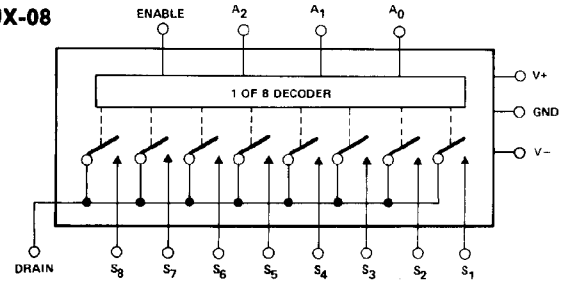
16-PIN CERDIP (Q-Suffix)
16-PIN PLASTIC DIP (P-Suffix)
16-PIN SO (S-Suffix)



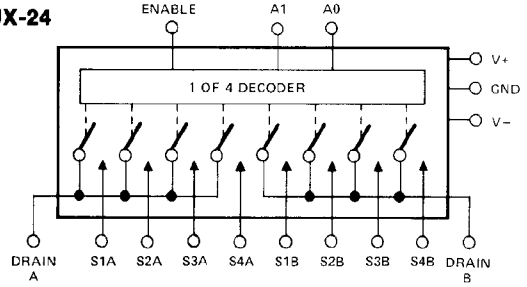
20-CONTACT LCC (RC-Suffix)

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

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 MIN	TYP	MAX	MUX-08B/F MUX-24B/F MIN	TYP	MAX	UNITS
"ON" Resistance	R_{ON}	$V_S \leq 10V$, $I_S \leq 200\mu A$		—	220	300	—	300	400	Ω
ΔR_{ON} With Applied Voltage	ΔR_{ON}	$-10V \leq V_S \leq 10V$, $I_S = 200\mu A$		—	1	5	—	3	7	%
R_{ON} Match Between Switches	R_{ON} Match	$V_S = 0V$, $I_S = 200\mu A$		—	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	— —	0.1 0.05	1.0 1.0	— —	0.1 0.05	2.0 2.0	nA
Leakage Current (Switch "ON")	$I_{D(ON)}$ $+I_{S(ON)}$	$V_D = 10V$ (Note 1)	MUX-08 MUX-24	— —	0.1 0.05	1.0 1.0	— —	0.1 0.05	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	— —	0.1 0.2	0.4 0.5	— —	0.2 0.3	0.4 0.6	μs
"OFF" Isolation	ISO_{OFF}	(Note 4) Figure 5 (Test Circuit)	MUX-08 MUX-24	— —	60 66	— —	— —	60 66	— —	dB
Crosstalk	CT	(Note 3) Figure 4 (Test Circuit)	MUX-08 MUX-24	— —	70 76	— —	— —	70 76	— —	dB
Source Capacitance	$C_{S(OFF)}$	Switch "OFF", $V_S = 0V$, $V_D = 0V$	MUX-08 MUX-24	— —	2.5 2	— —	— —	2.5 2	— —	pF
Drain Capacitance	$C_{D(OFF)}$	Switch "OFF", $V_S = 0V$, $V_D = 0V$	MUX-08 MUX-24	— —	7 4	— —	— —	7 4	— —	pF
Input to Output Capacitance	$C_{DS(OFF)}$	(Note 4)	MUX-08 MUX-24	— —	0.3 0.15	— —	— —	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

ELECTRICAL CHARACTERISTICS at V+ = 15V, V− = −15V and −55°C ≤ T_A ≤ 125°C, unless otherwise noted.

PARAMETER	SYMBOL	CONDITIONS		MUX-08A/ MUX-24A MIN	MUX-08A/ MUX-24A TYP	MUX-08A/ MUX-24A MAX	MUX-08B/ MUX-24B MIN	MUX-08B/ MUX-24B TYP	MUX-08B/ MUX-24B MAX	UNITS
"ON" Resistance	R_{ON}	V_S ≤ 10V, I_S ≤ 200μA		—	—	400	—	—	500	Ω
ΔR_{ON} With Applied Voltage	ΔR_{ON}	−10V ≤ V_S ≤ 10V, I_S = 200μA		—	1.5	—	—	4.5	—	%
R_{ON} Match Between Switches	R_{ON} Match	V_S = 0V, I_S = 200μA		—	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

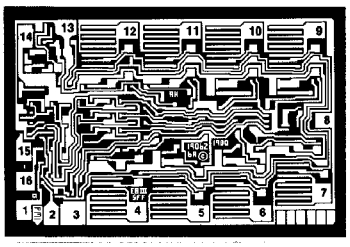
ELECTRICAL CHARACTERISTICS at V+ = 15V, V− = −15V and −25°C ≤ T_A +85°C for MUX-08EQ/FQ and MUX-24EQ/FQ; 0°C ≤ T_A ≤ +70°C for MUX-08EP and MUX-24EP; −40°C ≤ T_A ≤ +85°C for MUX-08FP/FS and MUX-24FP/FS, unless otherwise noted.

PARAMETER	SYMBOL	CONDITIONS		MUX-08E/ MUX-24E MIN	MUX-08E/ MUX-24E TYP	MUX-08E/ MUX-24E MAX	MUX-08F/ MUX-24F MIN	MUX-08F/ MUX-24F TYP	MUX-08F/ MUX-24F MAX	UNITS
"ON" Resistance	R_{ON}	V_S ≤ 10V, I_S ≤ 200μA		—	—	400	—	—	500	Ω
ΔR_{ON} With Applied Voltage	ΔR_{ON}	−10V ≤ V_S ≤ 10V, I_S = 200μA		—	1.5	—	—	4.5	—	%
R_{ON} Match Between Switches	R_{ON} Match	V_S = 0V, I_S = 200μA		—	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:

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

DICE CHARACTERISTICS (125° C TESTED DICE AVAILABLE)

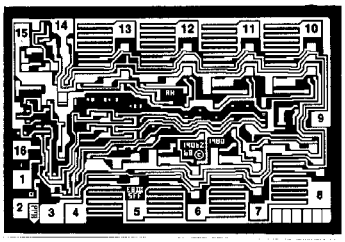


MUX-08

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

1. A0	9. S8
2. ENABLE	10. S7
3. V– (SUBSTRATE)	11. S6
4. S1	12. S5
5. S2	13. V+
6. S3	14. GND
7. S4	15. A2
8. DRAIN	16. A1

MUX-24



1. A0	9. DRAIN B
2. ENABLE	10. S4 B
3. V– (SUBSTRATE)	11. S3 B
4. S1 A	12. S2 B
5. S2 A	13. S1 B
6. S3 A	14. V+
7. S4 A	15. GND
8. DRAIN A	16. A1

WAFER TEST LIMITS at V+ = 15V, V– = –15V, T_A = 25°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 = 200μA		300	300	400	Ω MAX
			T_A = 125°C	400	—	—	
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		10	10	10	μA MAX
			T_A = 125°C	20	—	—	
Digital "0" Enable Current	$I_{INL(EN)}$	V_{IN} = 0.4V		10	10	10	μA MAX
			T_A = 125°C	20	—	—	
Positive Supply Current (All Digital Inputs Logic "0")	I+			12	12	12	mA MAX
			T_A = 125°C	15	—	—	
Negative Supply Current (All Digital Inputs Logic "0")	I–			3.8	3.8	3.8	mA MAX
			T_A = 125°C	5	—	—	
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 mehtods 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° C for MUX-08/24N & G, T_A = 125° 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 = 200μA	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

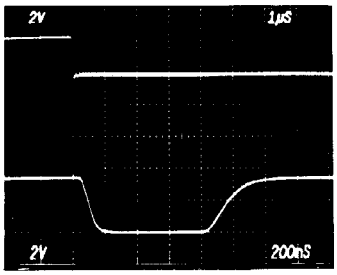
A_2	A_1	A_0	EN	"ON" CHANNEL
X	X	X	L	NONE
L	L	L	H	1
L	L	H	H	2
L	H	L	H	3
L	H	H	H	4
H	L	L	H	5
H	L	H	H	6
H	H	L	H	7
H	H	H	H	8

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

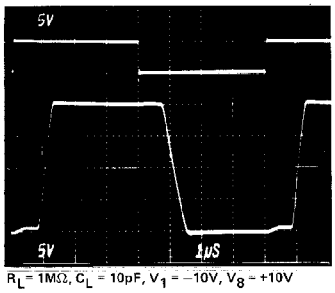
TYPICAL PERFORMANCE CHARACTERISTICS (Applies to all grades, unless otherwise noted.)

MUX-08
BREAK-BEFORE-MAKE SWITCHING



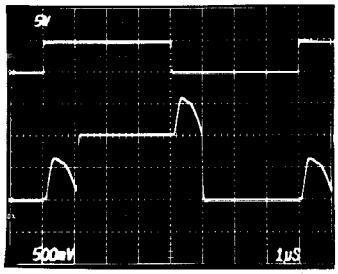
R_L = 1kΩ, C_L = 10pF, $V_{1,8}$ = 10V
VOLTAGE = 2V/DIV
TIME = 200ns/DIV

MUX-08
LARGE-SIGNAL SWITCHING



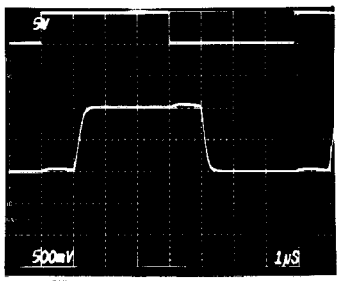
R_L = 1MΩ, C_L = 10pF, V_1 = −10V, V_8 = +10V
VOLTAGE = 5V/DIV
TIME = 1μs/DIV

MUX-08
SMALL-SIGNAL SWITCHING



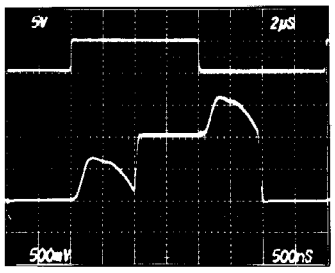
R_L = 1MΩ, C_L = 10pF, V_1 = −500mV, V_8 = +500mV
VOLTAGE = 500mV/DIV
TIME = 1μs/DIV

MUX-08
SMALL-SIGNAL SWITCHING WITH FILTERING



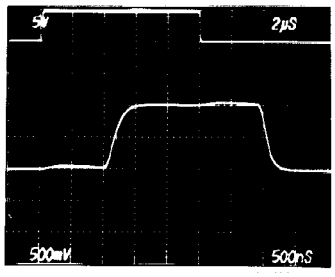
R_L = 1MΩ, C_L = 500pF, V_1 = 500mV, V_8 = +500mV
VOLTAGE = 500mV/DIV
TIME = 1μs/DIV

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



R_L = 1MΩ, C_L = 10pF, V_1 = −500mV, V_8 = +500mV
VOLTAGE = 500mV/DIV
TIME = 500ns/DIV

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

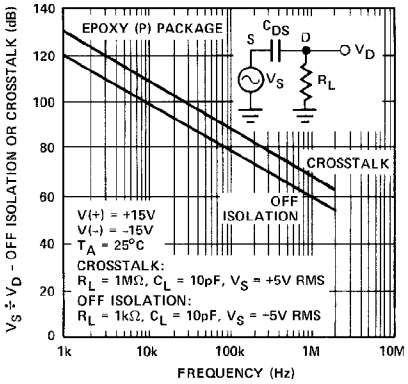


R_L = 1MΩ, C_L = 500pF, V_1 = −500mV, V_8 = +500mV
VOLTAGE = 500mV/DIV
TIME = 500ns/DIV

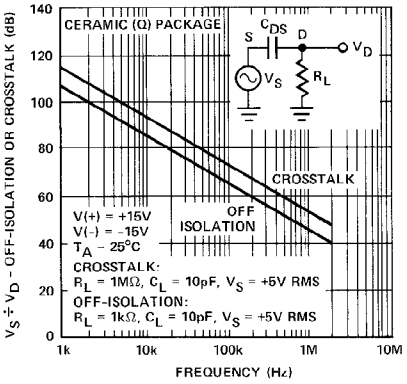
NOTE:
Top waveforms: Digital Input 5V/DIV
Bottom waveforms: Multiplexer Output

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

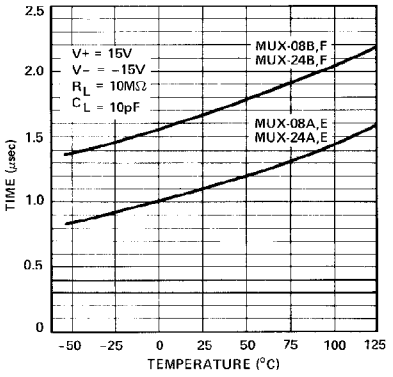
MUX-08 CROSSTALK AND OFF ISOLATION PERFORMANCE OF CHANNEL 8



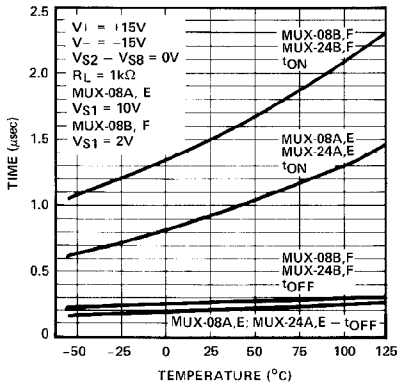
MUX-08 CROSSTALK AND OFF ISOLATION PERFORMANCE OF CHANNEL 8



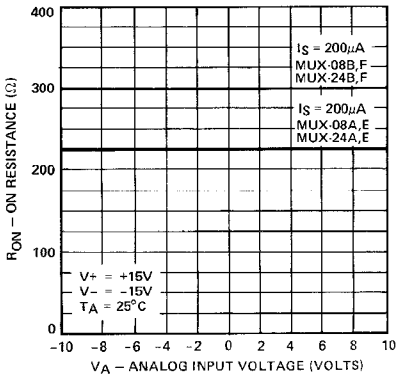
TRANSITION TIMES vs TEMPERATURE



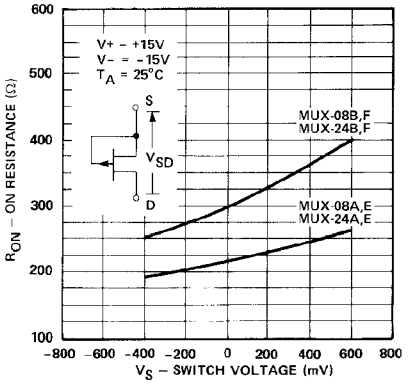
ENABLE DELAY TIMES vs TEMPERATURE



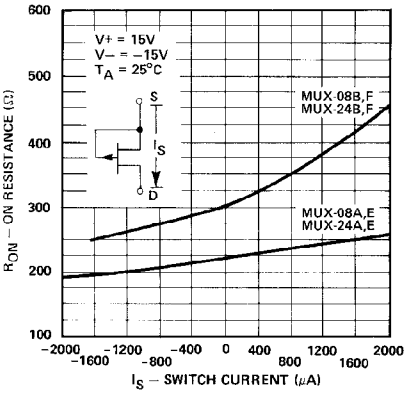
"ON" RESISTANCE (R_{ON}) vs ANALOG VOLTAGE (V_A)



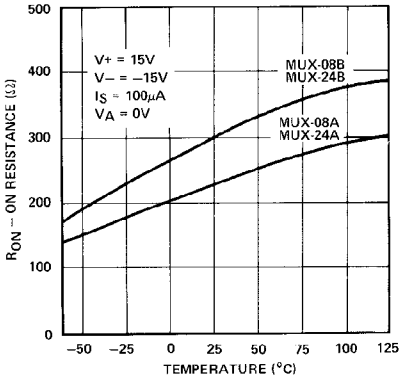
R_{ON} vs SWITCH VOLTAGE (V_{SD})



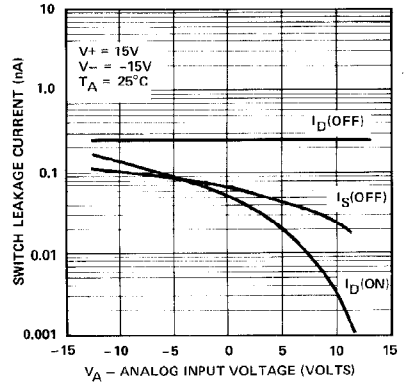
R_{ON} vs SWITCH CURRENT (I_S)



R_{ON} vs TEMPERATURE

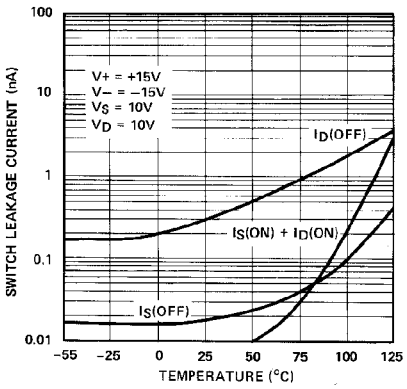


SWITCH LEAKAGE CURRENTS vs ANALOG INPUT VOLTAGE

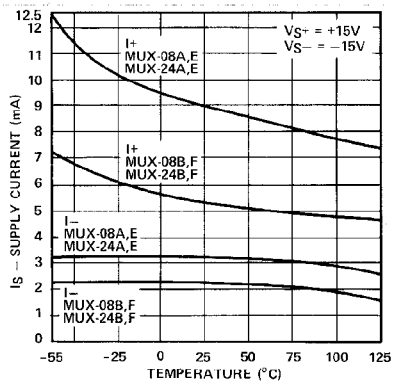


TYPICAL PERFORMANCE CHARACTERISTICS (Applies to all grades, unless otherwise noted.)

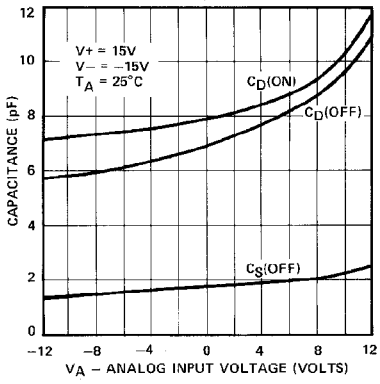
SWITCH LEAKAGE CURRENTS vs TEMPERATURE



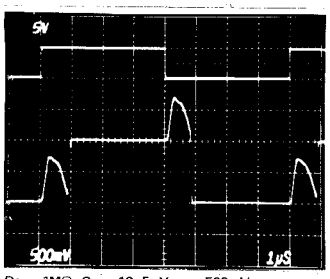
SUPPLY CURRENTS vs TEMPERATURE



MUX-08 SWITCH CAPACITANCES vs ANALOG INPUT VOLTAGE

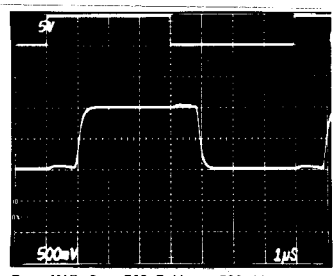


MUX-24 SMALL-SIGNAL SWITCHING



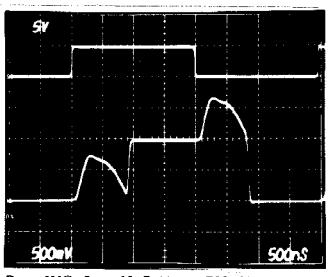
RL = 1MΩ, CL = 10pF, V1 = –500mV,
V4 = +500mV
VOLTAGE = 500mV/DIV, TIME = 1µs/DIV

MUX-24 SMALL-SIGNAL SWITCHING WITH FILTERING



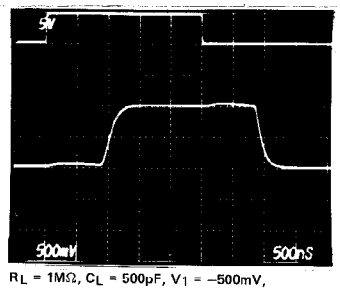
RL = 1MΩ, CL = 500pF, V1 = –500mV,
V4 = +500mV
VOLTAGE = 500mV/DIV, TIME = 1µs/DIV

MUX-24 SMALL-SIGNAL SWITCHING WITH 2µs SAMPLE TIME



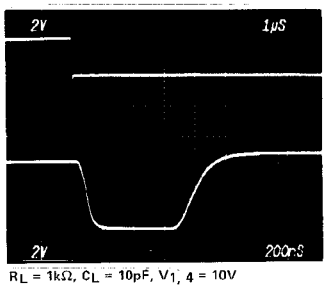
RL = 1MΩ, CL = 10pF, V1 = –500mV,
V4 = +500mV
VOLTAGE = 500mV/DIV, TIME = 500ns/DIV

MUX-24 SMALL-SIGNAL SWITCHING WITH FILTERING AND 2.5µs SAMPLE TIME



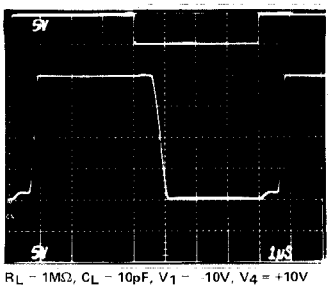
RL = 1MΩ, CL = 500pF, V1 = –500mV,
V4 = +500mV
VOLTAGE = 500mV/DIV, TIME = 500ns/DIV

MUX-24 BREAK-BEFORE-MAKE SWITCHING



RL = 1kΩ, CL = 10pF, V1, 4 = 10V
VOLTAGE = 2V/DIV, TIME = 200ns/DIV

MUX-24 LARGE-SIGNAL SWITCHING

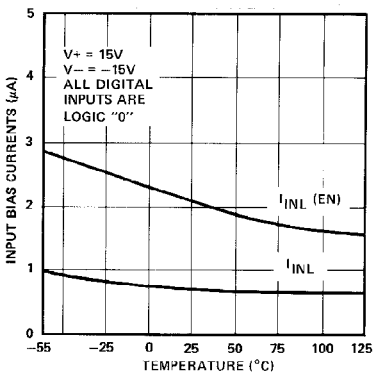


RL = 1MΩ, CL = 10pF, V1 = –10V, V4 = +10V
VOLTAGE = 5V/DIV, TIME = 1µs/DIV

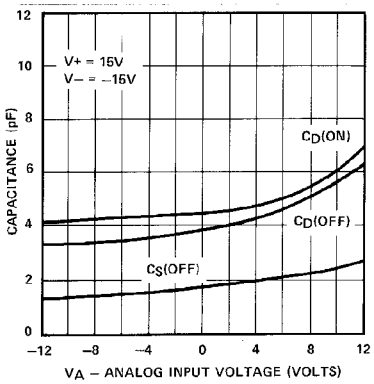
NOTE:
Top waveforms: Digital Input 5V/DIV
Bottom waveforms: Multiplexer Output

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

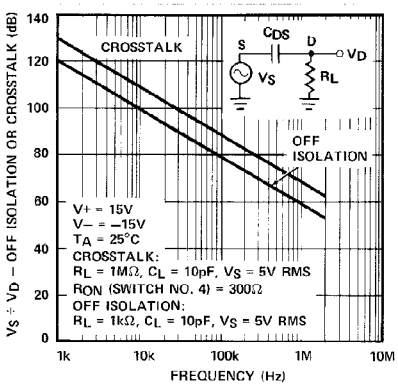
DIGITAL INPUT CURRENTS vs TEMPERATURE



MUX-24 SWITCH CAPACITANCES vs ANALOG INPUT VOLTAGE



MUX-24 CROSSTALK AND OFF ISOLATION PERFORMANCE OF CHANNEL 3A



A.C. TEST CIRCUITS

TRANSITION TIME TEST CIRCUIT

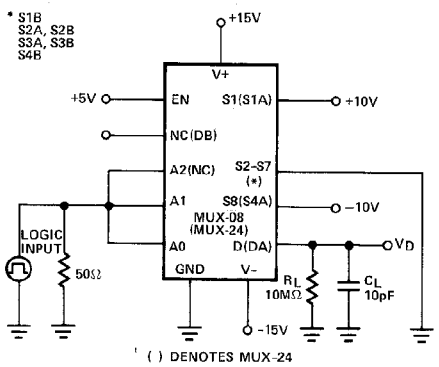


Figure 1

BREAK-BEFORE-MAKE TEST CIRCUIT

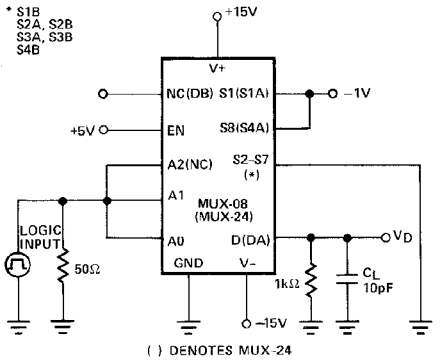


Figure 3

ENABLE DELAY TIME TEST CIRCUIT

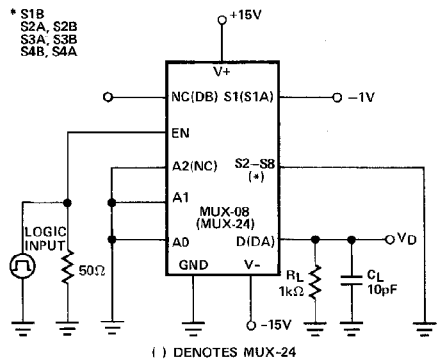


Figure 2

CROSSTALK MEASUREMENT CIRCUIT

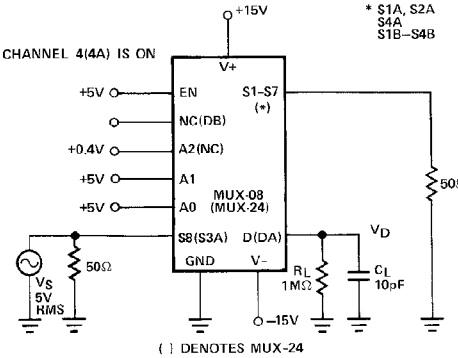


Figure 4

A.C. TEST CIRCUITS

OFF-ISOLATION MEASUREMENT CIRCUIT

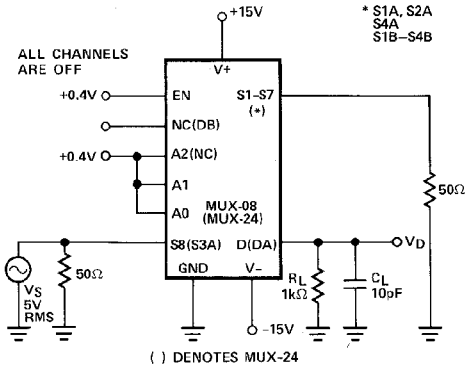
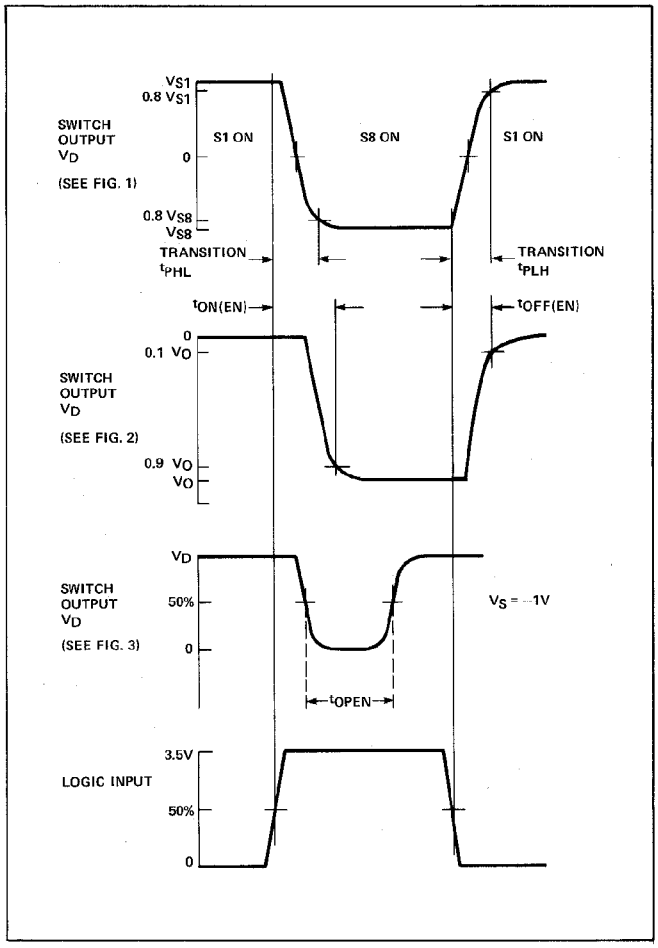


Figure 5

SWITCHING TIME WAVEFORMS



APPLICATIONS INFORMATION

These analog multiplexers employ ion-implanted JFETs in a switch configuration designed to assure break-before-make action. The turn-off time is much faster than the turn-on time to guarantee this feature over the full operating temperature and input voltage range. Fabricated with Bipolar-JFET processing, **special handling as required with CMOS devices, is not necessary to prevent damage to this multiplexer.** Because the digital inputs only require a 2.0V logic "1" input level, power-consuming pull-up resistors are not required for TTL compatibility to insure break-make switching as is most often the case with CMOS multiplexers. The digital inputs utilize PNP input transistors where input current is maximum at the logic "0" level and drops to that of a reverse-biased diode (about 10nA) as the input voltage is raised above ≈ 1.4V.

The "ON" resistance, R_{ON}, of the analog switches is constant over the wide input voltage range of −15V to +11V with $V_{SUPPLY} = \pm 15V$. Higher input voltage is tolerable provided that some form of current limiting is employed (such as that of an op-amp output stage) to avoid exceeding junction temperature and power dissipation requirements. For normal operation, however, positive input voltages should be restricted to 11V (or 4V less than the positive supply). This assures that the V_{GS} of an "OFF" switch remains greater than its V_p, and prevents that channel from being falsely turned "ON". When operating with negative input voltages, the gate-to-channel diode will be turned on if the voltage drop across an "ON" switch exceeds −0.6V. While this condition will cause an error in the output, it will not damage the switch. In lab tests, the multiplexer output has been loaded with a 0.01μF capacitor in the circuit of Figure 1. With $V_1 = -10V$ and $V_8 = +10V$, the logic input was driven at a 1kHz rate. The positive-going slew rate was 0.3V/μs which is equivalent to a normal I_{DSS} of 3mA. The negative-going slew rate was 0.7V/μs which is equivalent to a "reverse" I_{DSS} of 7mA. Note that when switch 1 is first turned "ON" it has a drop of −20V across its terminals. In spite of that fact, the current is limited to approximately twice its normal I_{DSS}.

CROSSTALK AND OFF-ISOLATION

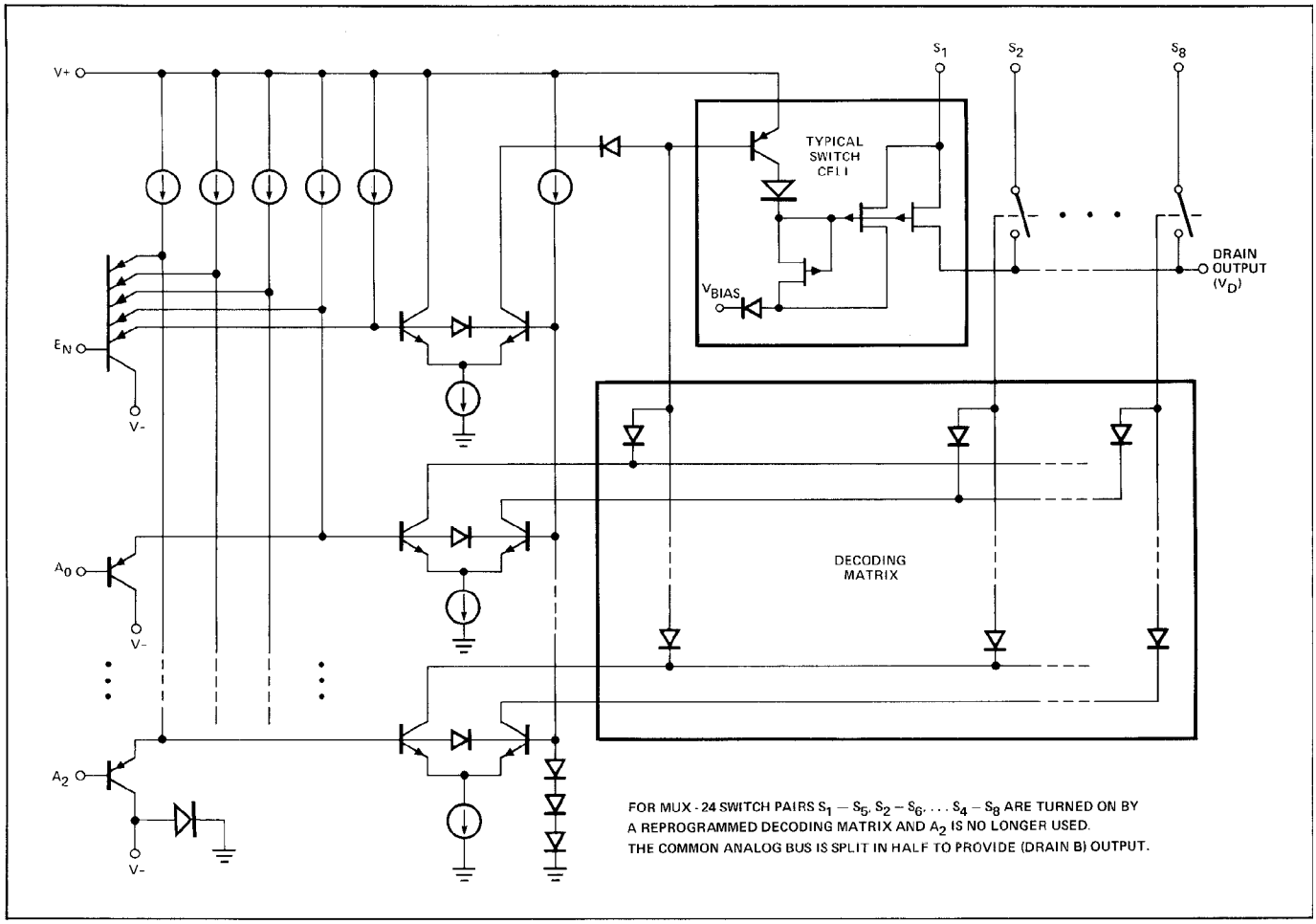
Crosstalk and off-isolation performance is influenced by the type of package selected. Epoxy (P) packaged devices typically exhibit a 12dB improvement in off-isolation (f = 500kHz) performance when compared to ceramic (Q) packaged devices. Epoxy packaged devices typically exhibit a 15dB improvement in crosstalk (f = 500kHz) performance when compared to ceramic (Q) packaged devices.

SINGLE SUPPLY OPERATION OF JFET MULTIPLEXERS

PMI's JFET multiplexers will operate from a single positive supply voltage with the negative supply pin at ground potential. The analog signal range will include ground.

For complete single supply operation information, refer to application note, AN-32.

SIMPLIFIED MUX-08 SCHEMATIC



The simplified MUX-08/MUX-24 schematic shows that logic trip points are determined by two forward diode drops. An internal clamping diode between V− and ground prevents excessive current flow between V+ and ground in the event that V− becomes open circuit. The decoding matrix is accomplished by a programmed diode array. The switch cell consists of P channel JFET's with appropriate blocking diodes which ruggedizes the circuit's overvoltage and supply loss characteristics.

DIFFERENTIAL MULTIPLEXERS

One characteristic unique to differential multiplexers (MUX-24) is the ability to reject common-mode signals from becoming differential error signals. Common-mode rejection is a parameter which defines the amount of rejection in terms of dB. The MUX-24 exhibits a 106dB at 60Hz and 101dB at 400Hz of CMRR using the test circuit of Figure 6.

CMRR TEST CIRCUIT

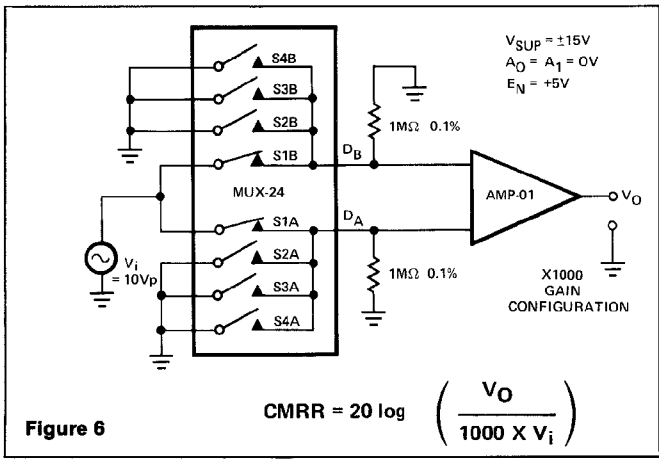
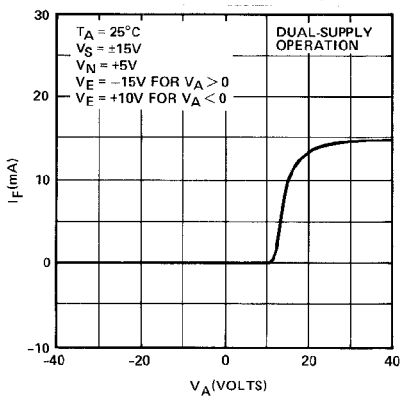


Figure 6

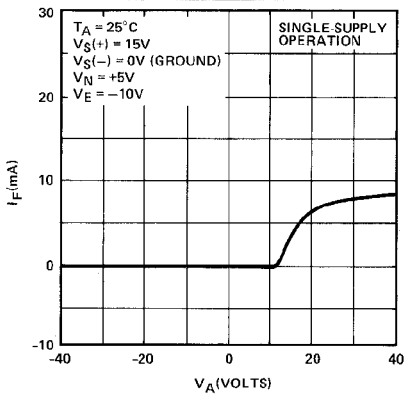
$$CMRR = 20 \log \left(\frac{V_O}{1000 \times V_i} \right)$$

TYPICAL PERFORMANCE CHARACTERISTICS

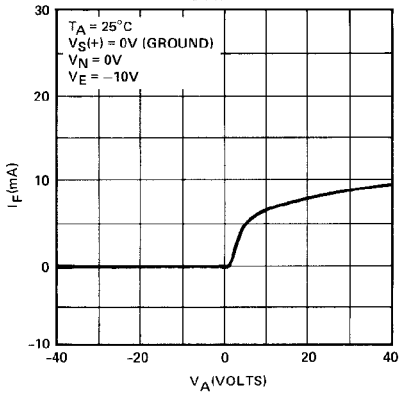
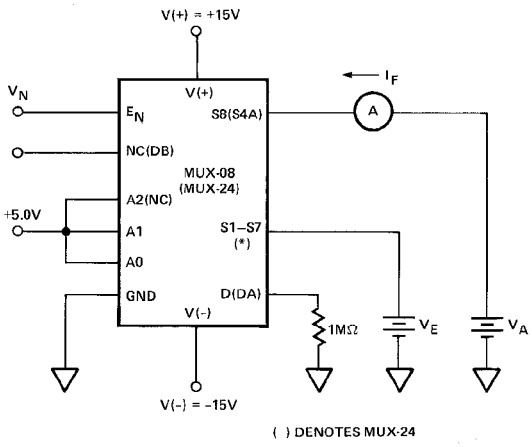
OVERVOLTAGE V-I CHARACTERISTIC



OVERVOLTAGE V-I CHARACTERISTIC



POWER-LOSS V-I CHARACTERISTIC



OVERVOLTAGE/POWER-LOSS MEASUREMENT TEST CIRCUIT