



MUX-16/MUX-28

FEATURES

- JFET Switches Rather Than CMOS
- Highly Resistant To Static Discharge Damage
- No SCR Latch-up Problems
- Low "ON" Resistance — 290Ω Typical
- Low Leakage Current
- Digital Inputs Compatible With TTL and CMOS
- Break-Before-Make Action
- 125° C Temperature-Tested Dice Available
- Overvoltage Protected
- Supply Loss Protection
- MUX-16 Pin Compatible With DG506, HI-506A, AD7506
- MUX-28 Pin Compatible With DG507, HI-507A, AD7507
- Available In Die Form

ORDERING INFORMATION †

25°C RESISTANCE	PACKAGE			OPERATING TEMPERATURE RANGE
	CERDIP 28-PIN	LCC 28-CONTACT	PLASTIC 28-PIN	
290Ω	MUX16AT*	—	—	MIL
290Ω	MUX16ET	—	—	IND
400Ω	MUX16BT*	MUX16BTC/883	—	MIL
400Ω	MUX16FT	—	MUX16FP	XIND
400Ω	—	—	MUX16FPC	XIND
290Ω	MUX28AT*	—	—	MIL
290Ω	MUX28ET	—	—	IND
400Ω	MUX28BT*	MUX28BTC/883	—	MIL
400Ω	MUX28FT	—	MUX28FP	XIND
400Ω	—	—	MUX28FPC	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.

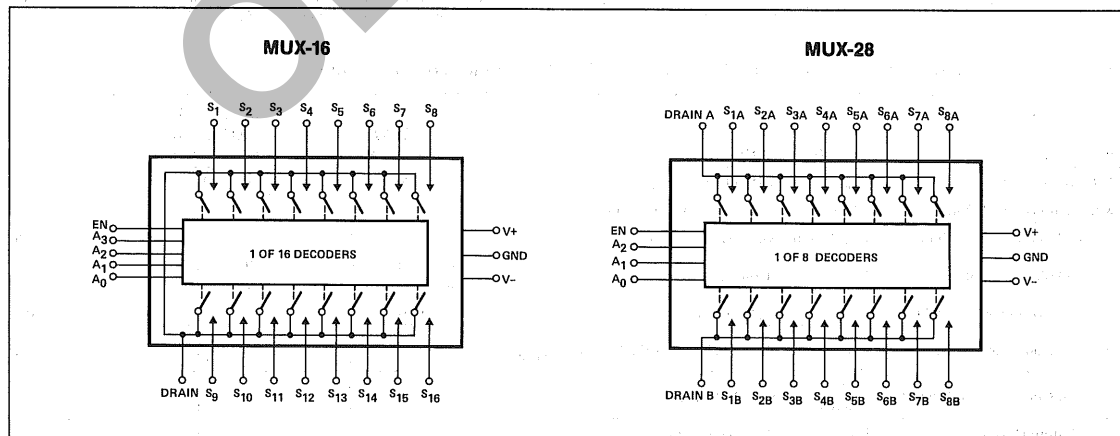
GENERAL DESCRIPTION

The MUX-16 is a monolithic 16-channel analog multiplexer which connects a single output to 1 of the 16 analog inputs depending upon the state of a 4-bit binary address. Disconnection of the output is provided by a logical "0" at the ENABLE input, thereby providing a package selection function.

The MUX-28 is a monolithic 8-channel differential analog multiplexer configured in a double pole, 8-position (plus OFF) electronic switch array. A 3-bit binary input address connects a pair of independent analog inputs from each 8-channel input section to the corresponding pair of independent analog outputs. Disconnection of both inputs is provided by a logical "0" at the ENABLE input, thereby offering a package select function.

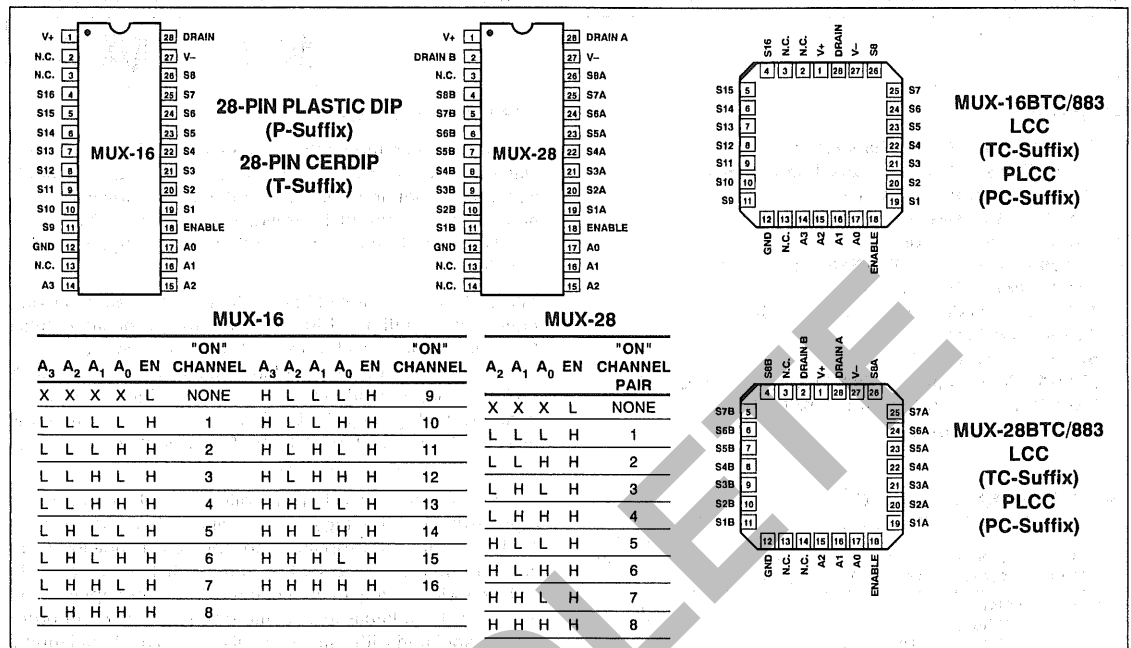
Fabricated with Precision Monolithics' high performance Bipolar-JFET technology, these devices offer low, constant "ON" resistance. Performance advantages include low leakage currents and fast settling time with low crosstalk to satisfy a wide variety of applications. These multiplexers do not suffer from latch-up or static discharge 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. For single 8-channel and dual 4-channel models, refer to the MUX-08/MUX-24 data sheet.

FUNCTIONAL DIAGRAMS



MUX-16/MUX-28

PIN CONNECTIONS & TRUTH TABLES



ABSOLUTE MAXIMUM RATINGS (Note 1)

Operating Temperature Range,

MUX-16/28-AT, BT, BTC -55°C to +125°C

MUX-16/28-ET -25°C to +85°C

MUX-16/28-FP, FPC, FT -40°C to +85°C

Junction Temperature (T_J) -65°C to +150°C

Storage Temperature Range -65°C to +150°C

Lead Temperature (Soldering, 60 sec) 300°C

Maximum Junction Temperature 150°C

V₊ Supply to V₋ Supply 36V

Logic Input Voltage (V₋ or -4V) 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
28-Pin Hermetic DIP (T)	55	15	°C/W
28-Pin Plastic DIP (P)	56	30	°C/W
28-Contact LCC (TC)	86	35	°C/W
28-Contact PLCC (PC)	70	33	°C/W

NOTES:

1. 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 PLCC package.

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

PARAMETER	SYMBOL	CONDITIONS	MUX-16A/E MUX-28A/E			MUX-16B/F MUX-28B/F			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
"ON" Resistance	R _{ON}	V _S ≤ 10V, I _S ≤ 200μA	—	290	380	—	400	580	Ω
ΔR _{ON} With Applied Voltage	ΔR _{ON}	-10V ≤ V _S ≤ 10V, I _S = 200μA	—	1.5	5	—	1.5	5	%
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	+11 -15	—	+10 -10	+11 -15	—	V
Source Current (Switch "OFF")	I _S (OFF)	V _S = 10V, V _D = -10V (Note 1)	—	0.01	1	—	0.01	2	nA
Drain Current (Switch "OFF")	I _D (OFF)	V _S = 10V, V _D = -10V (Note 1)	MUX-16 MUX-28	— 0.1	1 1	— 0.1	0.2 2	2	nA
Leakage Current (Switch "ON")	I _D (ON) +I _S (ON)	V _D = 10V (Note 1)	MUX-16 MUX-28	— 0.1	0.2 1	— 0.1	0.2 2	2	nA
Digital Input Current	I _{IN}	V _{IN} = 0.4V to 15V	—	1	10	—	1	10	μA

MUX-16/MUX-28

ELECTRICAL CHARACTERISTICS at $V_S = \pm 15V$ and $T_A = +25^\circ C$, unless otherwise noted. *Continued*

PARAMETER	SYMBOL	CONDITIONS	MUX-16A/E MUX-28A/E			MUX-16B/F MUX-28B/F			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
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}	(Notes 2,5) Figure 1 (Test Circuits)	—	1.4	2.0	—	1.8	2.5	μs
	t_{PLH}		—	1.2	1.8	—	1.6	2.2	μs
Output Settling Time	t_s	10V Step to 0.10%	—	2.6	—	—	2.7	—	μs
		10V Step to 0.05%	—	3.2	—	—	3.4	—	μs
		10V Step to 0.02%	—	4.0	—	—	7.2	—	μs
Break-Before-Make Delay	t_{OPEN}	Figure 3	—	0.7	—	—	1	—	μs
Enable Delay "ON"	$t_{ON (EN)}$	(Note 5) Figure 2 (Test Circuits)	—	1	2	—	1.2	2.5	μs
Enable Delay "OFF"	$t_{OFF (EN)}$	(Note 5) Figure 2 (Test Circuits)	MUX-16 MUX-28	0.25	0.5	—	0.25	0.5	μs
				0.25	0.5	—	0.25	0.6	μs
"OFF" Isolation	ISO_{OFF}	(Note 4) Figure 4 (Test Circuits)	—	66	—	—	66	—	dB
Crosstalk	CT	(Note 3) Figure 5 (Test Circuits)	—	75	—	—	75	—	dB
Source Capacitance	$C_S (OFF)$	Switch "OFF," $V_S = 0V, V_D = 0V$	—	2.5	—	—	2.5	—	pF
Drain Capacitance	$C_{D (OFF)}$	Switch "OFF," $V_S = 0V, V_D = 0V$	MUX-16 MUX-28	13	—	—	13	—	pF
				8	—	—	8	—	pF
Input to Output Capacitance	$C_{DS (OFF)}$	(Note 4)	—	0.15	—	—	0.15	—	pF
Positive Supply Current (All Digital Inputs Logic "0" or "1")	I_+	$V_+ = 15V$	MUX-16	15	19	—	9	19	mA
			MUX-28	15	19	—	8	19	
		$V_+ = 5V$	MUX-16	12	—	—	8	—	
			MUX-28	12	—	—	7	—	
Negative Supply Current (All Digital Inputs Logic "0" or "1")	I_-	$V_- = -15V$	MUX-16	5	7	—	3.5	7	mA
			MUX-28	5	7	—	3	7	
		$V_- = -5V$	MUX-16	4	—	—	3	—	
			MUX-28	4	—	—	2.5	—	

NOTES:

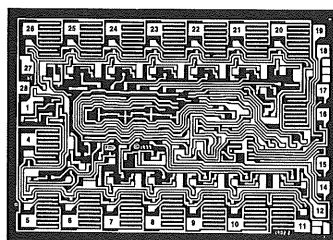
- Conditions applied to leakage tests insure worst case leakages.
- $R_L = 10M\Omega$, $C_L = 10pF$.
- Crosstalk is measured by driving channel 8 (8B*) with channel 7 (7B*) ON.
 $R_L = 1M\Omega$, $C_L = 10pF$, $V_S = 5V$ RMS, $f = 500kHz$.
- "OFF" Isolation is measured by driving channel 8 (8B) with 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.

ELECTRICAL CHARACTERISTICS at $V_S = \pm 15V$, $-55^\circ C \leq T_A \leq +125^\circ C$ for MUX-16AT/BT/BTC and MUX-28AT/BT/BTC; $-25^\circ C \leq T_A \leq +85^\circ C$ for MUX-16ET and MUX-28ET; $-40^\circ C \leq T_A \leq +85^\circ C$ for MUX-16 FT/FP/FPC and MUX-28FT/FP/FPC, unless otherwise noted.

PARAMETER	SYMBOL	CONDITIONS	MUX-16A/E MUX-28A/E			MUX-16B/F MUX-28B/F			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
"ON" Resistance	R_{ON}	$V_S \leq 10, I_S \leq 200\mu A$	—	—	500	—	—	800	Ω
ΔR_{ON} With Applied Voltage	ΔR_{ON}	$-10V \leq V_S \leq 10V, I_S = 200\mu A$	—	2	—	—	5.5	—	%
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	+11 -15	—	+10 -10	+11 -15	—	V
Source Current (Switch "OFF")	$I_S (OFF)$	$V_S = 10V, V_D = -10V$ (Note 1)	—	—	25	—	—	50	nA
Drain Current (Switch "OFF")	$I_D (OFF)$	$V_S = 10V, V_D = -10V$ (Note 1)	—	—	75	—	—	250	nA
Leakage Current (Switch "ON")	$I_D (ON)$ $+I_S (ON)$	$V_D = 10V$ (Note 1)	—	—	75	—	—	250	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"	—	—	24	—	—	24	mA
Negative Supply Current	I_-	All Digital Inputs Logic "0" or "1"	—	—	8.2	—	—	8.2	mA

MUX-16/MUX-28

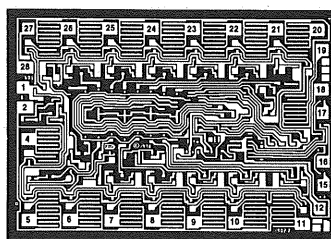
DICE CHARACTERISTICS (125°C TESTED DICE AVAILABLE)



MUX-16

MUX-28

DIE SIZE 0.110 × 0.076 inch, 8360 sq. mils
(2.794 × 1.930 mm, 5392 sq. mm)



- | | |
|------------------------|---------------------------------|
| 1. POSITIVE SUPPLY | 17. ADDRESS BIT 0 (A0) |
| 4. SOURCE 16 (S16) | 18. ENABLE |
| 5. SOURCE 15 (S15) | 19. SOURCE 1 (S1) |
| 6. SOURCE 14 (S14) | 20. SOURCE 2 (S2) |
| 7. SOURCE 13 (S13) | 21. SOURCE 3 (S3) |
| 8. SOURCE 12 (S12) | 22. SOURCE 4 (S4) |
| 9. SOURCE 11 (S11) | 23. SOURCE 5 (S5) |
| 10. SOURCE 10 (S10) | 24. SOURCE 6 (S6) |
| 11. SOURCE 9 (S9) | 25. SOURCE 7 (S7) |
| 12. GROUND | 26. SOURCE 8 (S8) |
| 14. ADDRESS BIT 3 (A3) | 27. NEGATIVE SUPPLY (SUBSTRATE) |
| 15. ADDRESS BIT 2 (A2) | 28. DRAIN |
| 16. ADDRESS BIT 1 (A1) | |

- | | |
|------------------------|---------------------------------|
| 1. POSITIVE SUPPLY | 17. ADDRESS BIT 0 (A0) |
| 2. DRAIN B | 18. ENABLE |
| 4. SOURCE 8 (S8B) | 19. SOURCE 1 (S1A) |
| 5. SOURCE 7 (S7B) | 20. SOURCE 2 (S2A) |
| 6. SOURCE 6 (S6B) | 21. SOURCE 3 (S3A) |
| 7. SOURCE 5 (S5B) | 22. SOURCE 4 (S4A) |
| 8. SOURCE 4 (S4B) | 23. SOURCE 5 (S5A) |
| 9. SOURCE 3 (S3B) | 24. SOURCE 6 (S6A) |
| 10. SOURCE 2 (S2B) | 25. SOURCE 7 (S7A) |
| 11. SOURCE 1 (S1B) | 26. SOURCE 8 (S8A) |
| 12. GROUND | 27. NEGATIVE SUPPLY (SUBSTRATE) |
| 15. ADDRESS BIT 2 (A2) | 28. DRAIN A |
| 16. ADDRESS BIT 1 (A1) | |

WAFER TEST LIMITS at $V_+ = 15V$, $V_- = -15V$, $T_A = 25^\circ C$ for MUX-16/28 N and G, $T_A = 125^\circ C$ for MUX-16/28 NT and GT, unless otherwise noted.

PARAMETER	SYMBOL	CONDITIONS	MUX-16/ MUX-28NT LIMIT	MUX-16/ MUX-28N LIMIT	MUX-16/ MUX-28GT LIMIT	MUX-16/ MUX-28G LIMIT	UNITS
"ON" Resistance	R_{ON}	$V_S = 0V$, $I_S = 200\mu A$	540	380	800	580	Ω MAX
Digital "1" Input Voltage	V_{INH}		2	2	2	2	V MIN
Digital "0" Input Voltage	V_{INL}		0.8	0.8	0.8	0.8	V MAX
Digital "0" Input Current	I_{INL}	$V_{IN} = 0.4V$	20	10	20	10	μA MAX
Digital "0" Enable Current	$I_{INL EN}$	$V_{EN} = 0.4V$	20	10	20	10	μA MAX
Positive Supply Current (All Digital Inputs Logic "0")	I_+		24	19	24	19	mA MAX
Negative Supply Current (All Digital Inputs Logic "0")	I_-		8.2	7	8.2	7	mA MAX
Analog Input Range	V_A	(Note 2)	± 10	± 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-16/28 N and G, $T_A = 125^\circ C$ for MUX-16/28 NT and GT, unless otherwise noted.

PARAMETER	SYMBOL	CONDITIONS	MUX-16/ MUX-28NT TYPICAL	MUX-16/ MUX-28N TYPICAL	MUX-16/ MUX-28GT TYPICAL	MUX-16/ MUX-28G TYPICAL	UNITS
Switching Time (t_{TRAN})	t_{PHL} t_{PLH}	(Note 1) Figure 1	2 1.8	1 0.9	2.6 2.4	1.5 1.4	μs
Output Settling Time	t_S	10V Step to 0.1% (Note 1)	2.5	1.5	2.9	1.9	μs
Break-Before-Make Delay	t_{OPEN}	(Note 1) Figure 3 (Test Circuits)	0.8	0.8	1	1	μs
Crosstalk	CT	(Note 1) Figure 5 (Test Circuits)	70	70	70	70	dB
ΔR_{ON} With Applied Voltage	ΔR_{ON}	$-10V \leq V_S \leq 10V$, $I_S = 200\mu A$	1.5	1.5	1.5	1.5	%
Leakage Current (Switch "ON")	$I_{D ON}$	$V_D = 10V$ (Note 1)	20	0.2	20	0.2	nA
Analog Input Range	V_A	(Note 2)	+11 -15	+11 -15	+11 -15	+11 -15	V

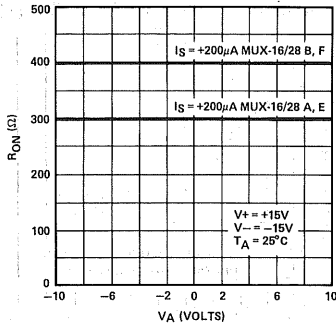
NOTES:

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

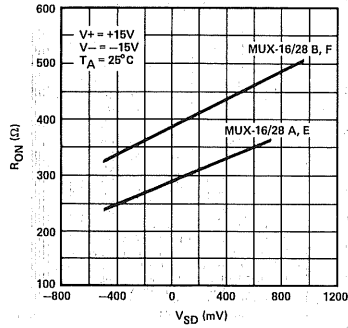
2. Guaranteed by R_{ON} and leakage current tests.

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

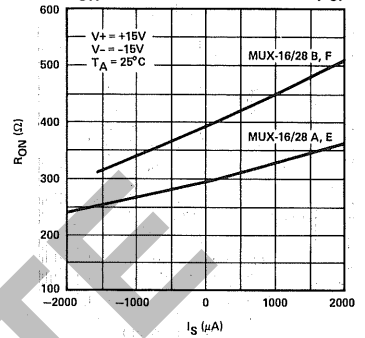
**"ON" RESISTANCE (R_{ON})
vs ANALOG VOLTAGE (V_A)**



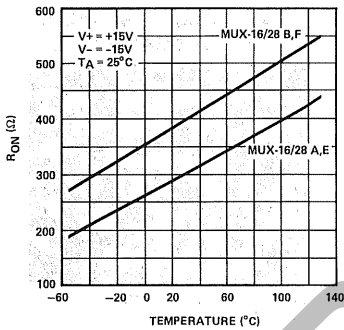
R_{ON} vs SWITCH VOLTAGE (V_{SD})



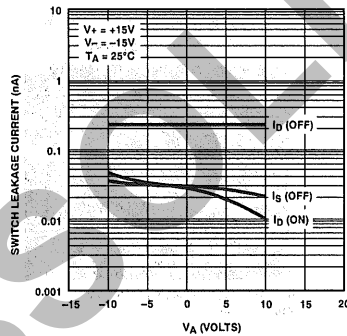
R_{ON} vs SWITCH CURRENT (I_S)



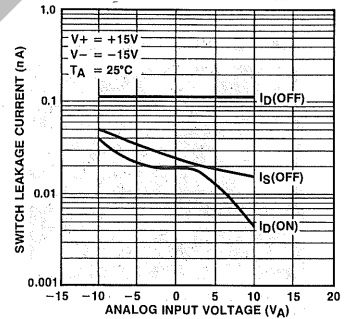
R_{ON} vs TEMPERATURE (T)



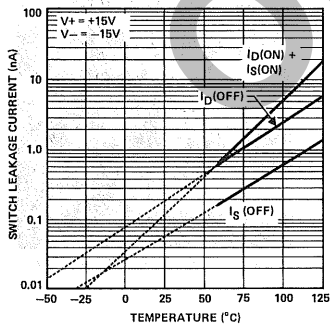
**MUX-16 SWITCH LEAKAGE
CURRENTS vs ANALOG
INPUT VOLTAGE (V_A)**



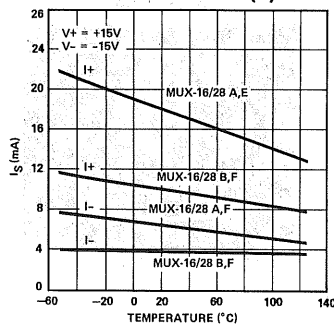
**MUX-28 SWITCH LEAKAGE
CURRENTS vs ANALOG
INPUT VOLTAGE (V_A)**



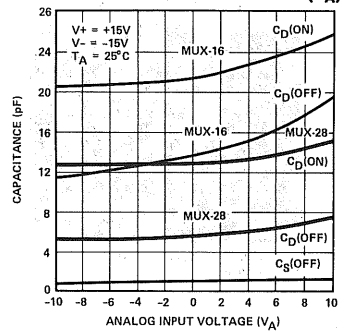
**SWITCH LEAKAGE CURRENTS
vs TEMPERATURE**



**SUPPLY CURRENTS vs
TEMPERATURE (T)**



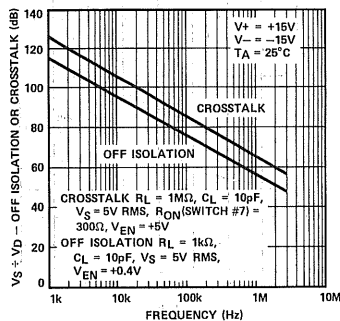
**SWITCH CAPACITANCES vs
ANALOG INPUT VOLTAGE (V_A)**



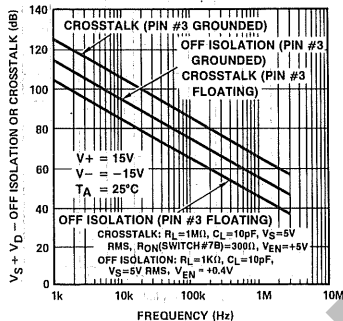
MUX-16/MUX-28

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

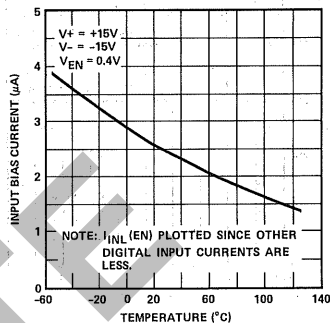
**MUX-16
OFF PERFORMANCE OF
CHANNEL 8**



**MUX-28
OFF PERFORMANCE OF
CHANNEL 8**

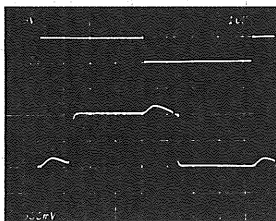


**DIGITAL INPUT BIAS
CURRENTS vs TEMPERATURE (T)**



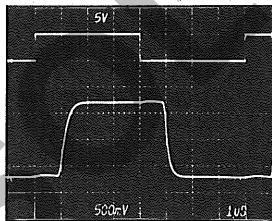
MUX-16 DYNAMIC CHARACTERISTIC CURVES

SMALL-SIGNAL SWITCHING



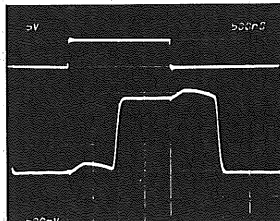
RL = 1MΩ, CL = 10pF, V1 = -500mV,
V16 = +500mV

**SMALL-SIGNAL SWITCHING
WITH FILTERING**



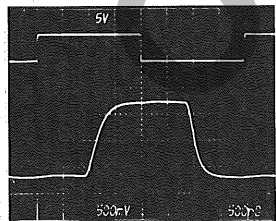
RL = 1MΩ, CL = 500pF, V1 = -500mV,
V16 = +500mV

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



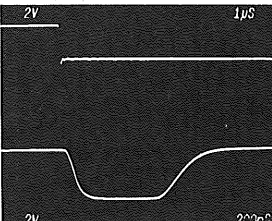
RL = 1MΩ, CL = 10pF, V1 = -700mV,
V16 = +700mV

**SMALL-SIGNAL SWITCHING
WITH FILTERING AND
2μs SAMPLE TIME**



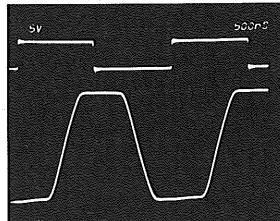
RL = 1MΩ, CL = 500pF, V1 = -700mV,
V16 = +700mV

**BREAK-BEFORE-MAKE
SWITCHING**



RL = 1kΩ, CL = 10pF, V1 = V16 = +10V

LARGE-SIGNAL SWITCHING



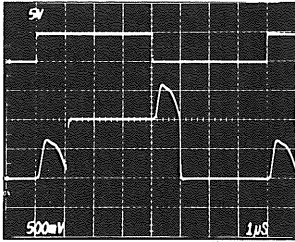
RL = 1MΩ, CL = 10pF, V1 = -10V, V16 = +10V

NOTE:

Top Waveforms: Digital Input 5V/Div
Bottom Waveforms: Multiplexer Output (VD)

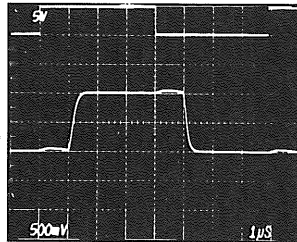
MUX-28 DYNAMIC CHARACTERISTIC CURVES

SMALL-SIGNAL SWITCHING



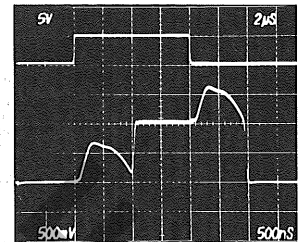
$R_L = 1M\Omega$, $C_L = 10pF$, $V_1 = -500mV$, $V_g = +500mV$

SMALL-SIGNAL SWITCHING WITH FILTERING



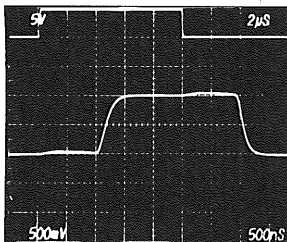
$R_L = 1M\Omega$, $C_L = 500pF$, $V_1 = -500mV$, $V_g = +500mV$

SMALL-SIGNAL SWITCHING WITH $2\mu s$ SAMPLE TIME



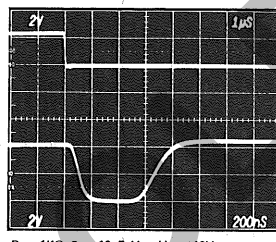
$R_L = 1M\Omega$, $C_L = 10pF$, $V_1 = -700mV$, $V_g = +700mV$

SMALL-SIGNAL SWITCHING WITH FILTERING AND $2.5\mu s$ SAMPLE TIME



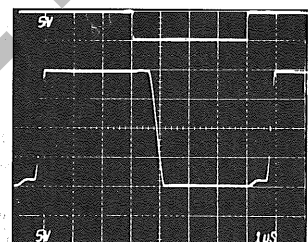
$R_L = 1M\Omega$, $C_L = 500pF$, $V_1 = -700mV$, $V_g = +700mV$

BREAK-BEFORE-MAKE SWITCHING



$R_L = 1K\Omega$, $C_L = 10pF$, $V_1 = V_g = +10V$

LARGE-SIGNAL SWITCHING



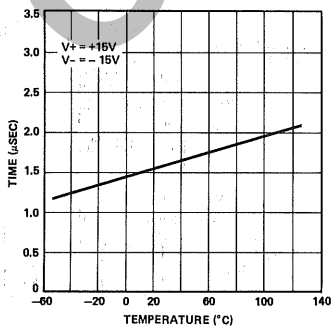
$R_L = 1M\Omega$, $C_L = 10pF$, $V_1 = -10V$, $V_g = +10V$

NOTE:

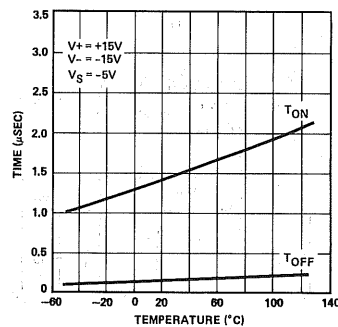
Top Waveforms: Digital Input 5V/Div
Bottom Waveforms: Multiplexer Output (V_D)

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

TRANSITION TIME vs TEMPERATURE



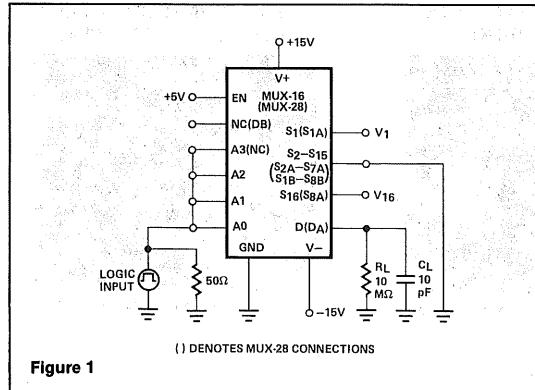
ENABLE DELAY TIME vs TEMPERATURE



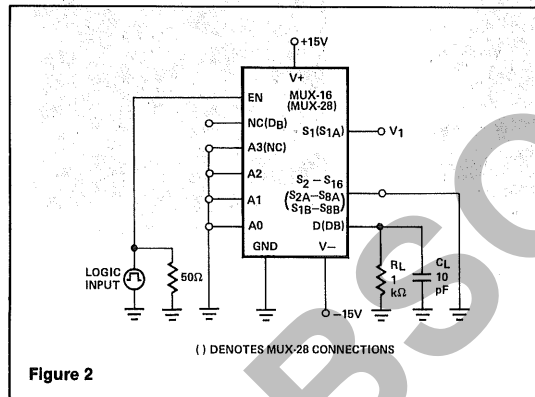
MUX-16/MUX-28

A.C. TEST CIRCUITS

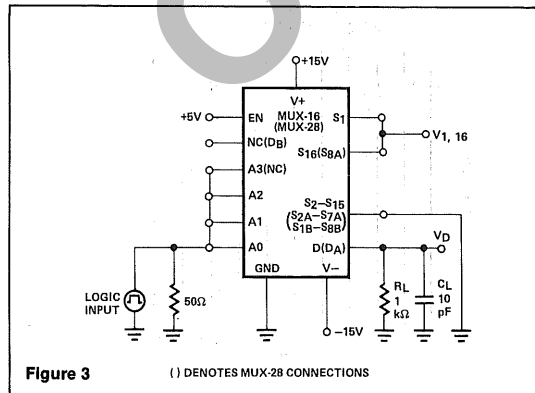
TRANSITION TIME TEST CIRCUIT



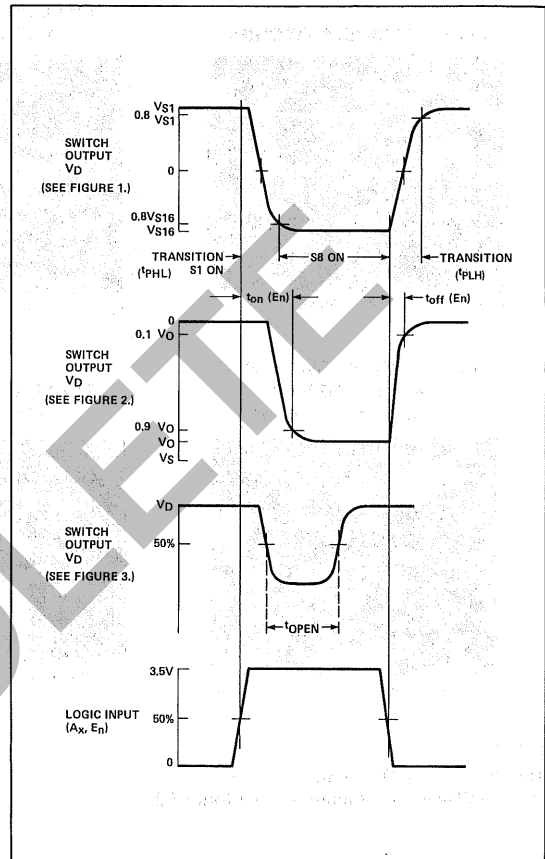
ENABLE DELAY TIME TEST CIRCUIT



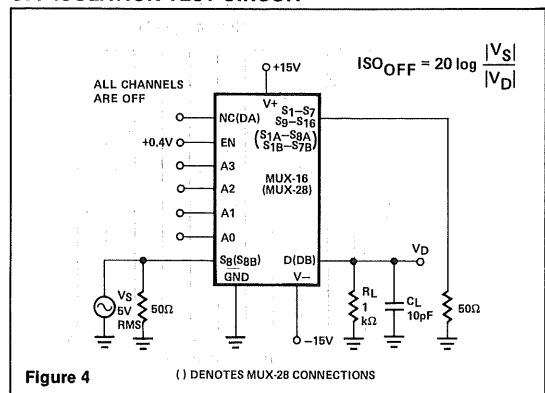
BREAK-BEFORE-MAKE TEST CIRCUIT



SWITCHING TIME WAVEFORMS



OFF ISOLATION TEST CIRCUIT



MUX-16/MUX-28

SIMPLIFIED SCHEMATIC (MUX-16)

