National Semiconductor

AM3705/AM3705C 8-Channel MOS Analog Multiplexer

General Description

The AM3705/AM3705C is an eight-channel MOS analog multiplex switch. TTL compatible logic inputs that require no level shifting or input pull-up resistors and operation over a wide range of supply voltage is obtained by constructing the device with low threshold P-channel enhancement MOS technology. To simplify external logic requirements, a one-of-eight decoder and an output enable are included in the device.

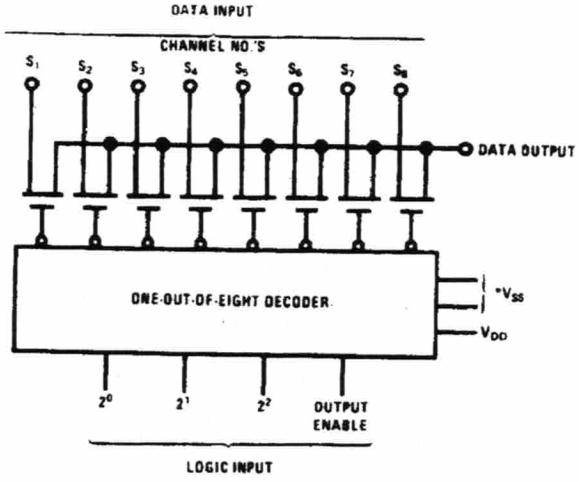
Important design features include:

- TTL/DTL compatible input logic levels
- Operation from standard +5V and −15V supplies
- Wide analog voltage range − ±5V
- One-of-eight decoder on chip
- Output enable control
- Low ON resistance - 150Ω
- Input gate protection
- Low leakage currents - 0.5 nA

The AM3705/AM3705C is designed as a low cost analog multiplex switch to fulfill a wide variety of data acquisition and data distribution applications including cross-point switching, MUX front ends for A/D converters, process controllers, automatic test gear, programmable power supplies and other military or industrial instrumentation applications.

The AM3705 is specified for operation over the −55°C to +125°C military temperature range. The AM3705C is specified for operation over the −25°C to +85°C temperature range.

Block and Connection Diagrams (MIL-STD-806B)



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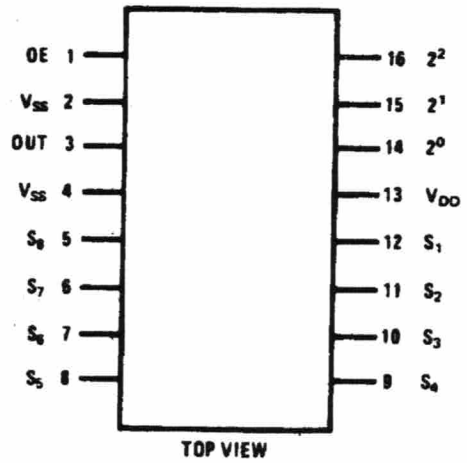
*Both V_{SS} lines are internally connected; either one or both may be used.

Dual-In-Line Package



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Order Number AM3705D or AM3705CD
See NS Package D16A

Order Number AM3705F or AM3705CF
See NS Package F16A

Truth Table

LOGIC INPUTS				CHANNEL
2^0	2^1	2^2	OE	ON
L	L	L	H	S_1
H	L	L	H	S_2
L	H	L	H	S_3
H	H	L	H	S_4
L	L	H	H	S_5
H	L	H	H	S_6
L	H	H	H	S_7
H	H	H	H	S_8
X	X	X	L	OFF

Absolute Maximum Ratings

Positive Voltage on Any Pin (Note 1)	+0.3V	Operating Temperature Range AM3705	−55°C to +125°C
Negative Voltage on Any Pin (Note 1)	−35V	AM3705C	−25°C to +85°C
Source to Drain Current	±30mA	Storage Temperature Range	−65°C to +150°C
Logic Input Current	±0.1 mA	Lead Temperature (Soldering, 10 sec)	300°C
Power Dissipation (Note 2)	500 mW		

Electrical Characteristics (Note 3)

Parameter	Symbol	Conditions	Limits			Units
			Min	Typ	Max	
ON Resistance	R_{ON}	$V_{IN}=V_{SS}$; $I_{OUT}=100\mu A$		80	250	Ω
ON Resistance	R_{ON}	$V_{IN}=-5V$; $I_{OUT}=-100\ \mu A$		160	400	Ω
ON Resistance AM3705 AM3705C	R_{ON}	$V_{IN}=-5V$; $I_{OUT}=-100\ \mu A$ $T_A=+125°C$ $T_A=+70°C$			 400 400	 Ω Ω
ON Resistance	R_{ON}	$V_{IN}=+5V$; $C_{DD}=-15V$; $I_{OUT}=100\ \mu A$		 100		 Ω
ON Resistance	R_{ON}	$V_{IN}=0V$, $V_{DD}=-55V$, $I_{OUT}=-100\ \mu A$		 150		 Ω
ON Resistance	R_{ON}	$V_{IN}=-5V$; $V_{DD}=-15V$ $I_{OUT}=-100\ \mu A$		 250		 Ω
OFF Resistance	R_{OFF}			10^{10}		Ω
Output Leakage Current AM3705 AM3705C	I_{LO} I_{LO} I_{LO}	$V_{SS}-V_{OUT}=15V$ $V_{SS}-V_{OUT}=15V$; $T_A=125°C$ $V_{SS}-V_{OUT}=15V$; $T_A=70°C$		0.5 150 35	10 500 500	nA nA nA
Data Input Leakage Current AM3705 AM3705	I_{LDI} I_{LDI} I_{LDI}	$V_{SS}-V_{IN}=15V$ $V_{SS}-V_{IN}=15V$; $T_A=125°C$ $V_{SS}-V_{IN}=15V$; $T_A=70°C$		0.1 25 0.5	3.0 500 500	nA nA nA
Logic Input Leakage Current AM3705 AM3705C	I_{LI} I_{LI} I_{LI}	$V_{SS}-V_{Logic\ In}=15V$ $V_{SS}-V_{Logic\ In}=15V$; $T_A=125°C$ $V_{SS}-V_{Logic\ In}=15V$; $T_A=70°C$		.001 .05 .05	1 10 10	μA μA μA
Logic Input LOW Level	V_{IL}	$V_{SS}=+5.0V$		0.5	1.0	V
Logic Input LOW Level	V_{IL}		V_{DD}		$V_{SS}-4.0$	V
Logic Input HIGH Level	V_{IH}	$V_{SS}=+5.0V$	3.0	3.5		V
Logic Input HIGH Level	V_{IH}		$V_{SS}-2.0$		$V_{SS}+0.3$	V
Channel Switching Time-Positive Channel Switching Time-Negative	t^+ t^-	} Switching Time } Test Circuit		300 600		ns ns
Channel Separation		f = 1 kHz		62		dB
Output Capacitance	C_{db}	$V_{SS}-V_{OUT}=0$; f = 1 MHz		35		pF
Data Input Capacitance	C_{sb}	$V_{SS}-V_{DIP}=0$; f = 1 MHz		6.0		pF
Logic Input Capacitance	C_{cg}	$V_{SS}-V_{Logic\ In}=0$; f = 1 MHz		6.0		pF
Power Dissipation	P_D	$V_{DD}=-31V$, $V_{SS}=0V$		125	175	mW

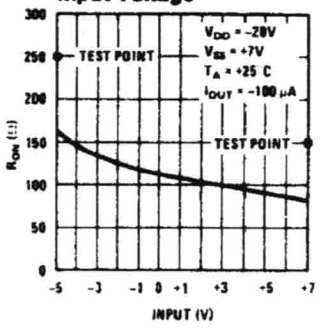
Note 1: All voltages referenced to V_{SS}.

Note 2: Ratings applies for ambient temperatures to +25°C, derate linearly at 3 mW/°C for ambient temperatures above +25°.

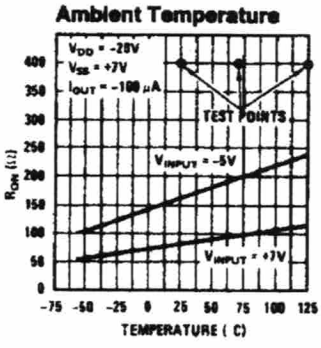
Note 3: Specifications apply for $T_A=25°C$, $-24V \le V_{DD} \le -20V$, and $+5.0V \le V_{SS} \le +7.0V$; unless otherwise specified (all voltages are referenced to ground.)

Typical Performance Characteristics

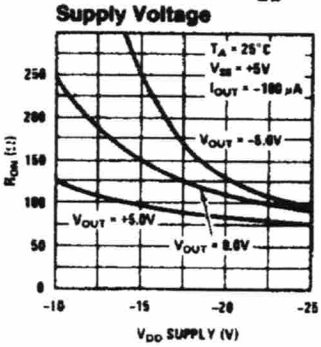
ON Resistance vs Analog Input Voltage



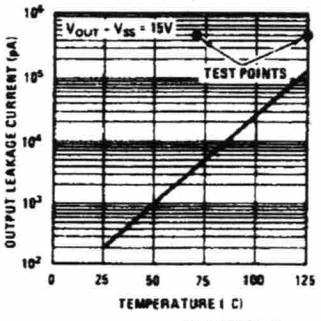
ON Resistance vs Ambient Temperature



ON Resistance vs V_{DD} Supply Voltage



Output Leakage Current vs Ambient Temperature



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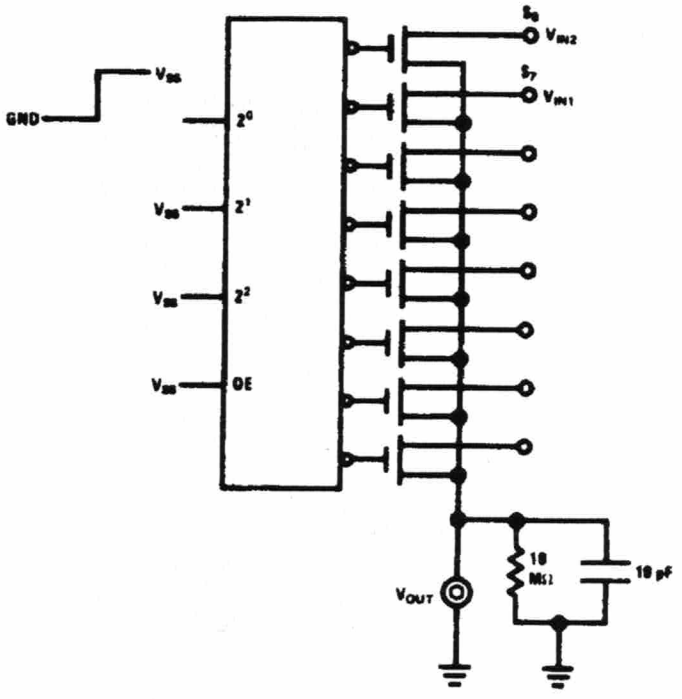
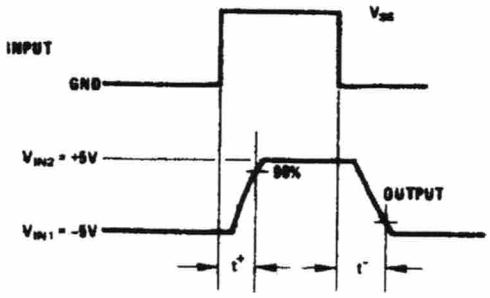
Switching Time Test Circuit





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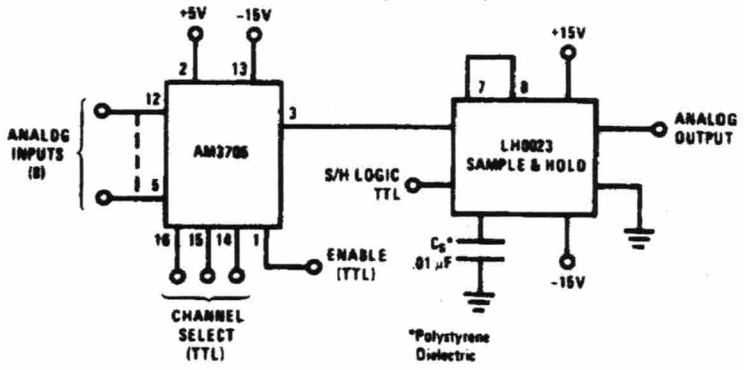
Typical Application

Buffered 8-Channel Multiplex, Sample and Hold



Analog Signal Range - 0.5V
Acquisition Time - 25 ns
Drift Rate - 0.5 mV/sec
Aperature Time - 250 ns

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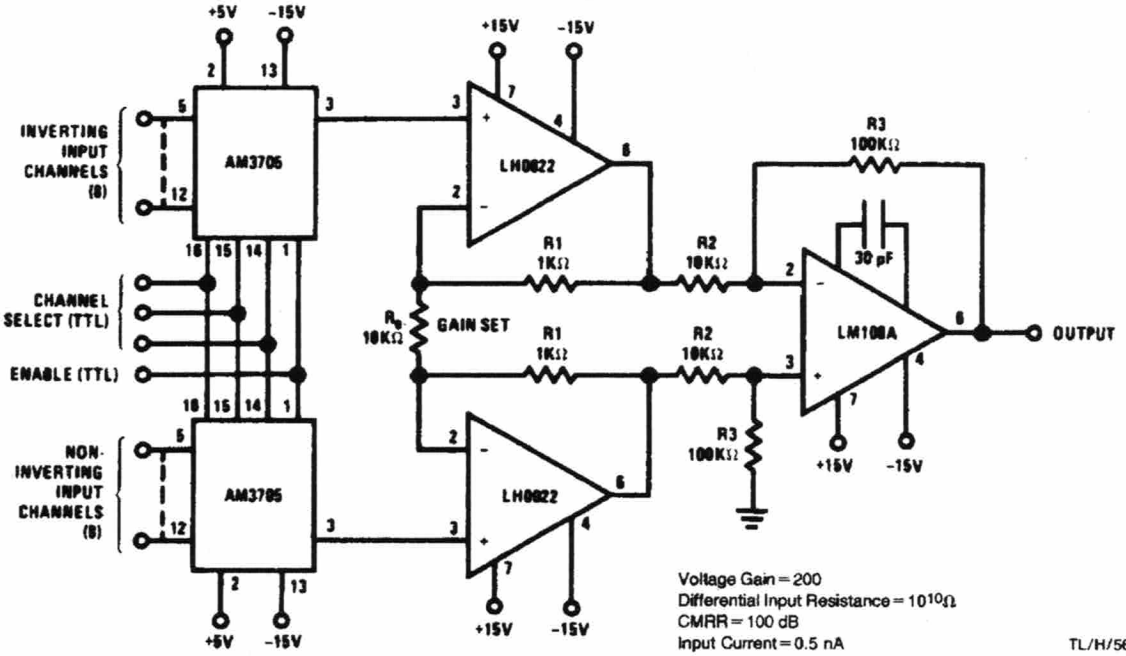
Differential Input MUX



Voltage Gain = 200
Differential Input Resistance = $10^{10}\Omega$
CMRR = 100 dB
Input Current = 0.5 nA

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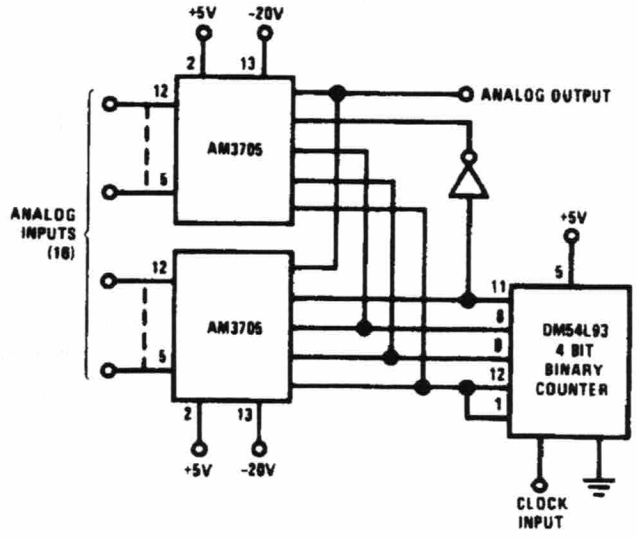
16-Channel Commutator



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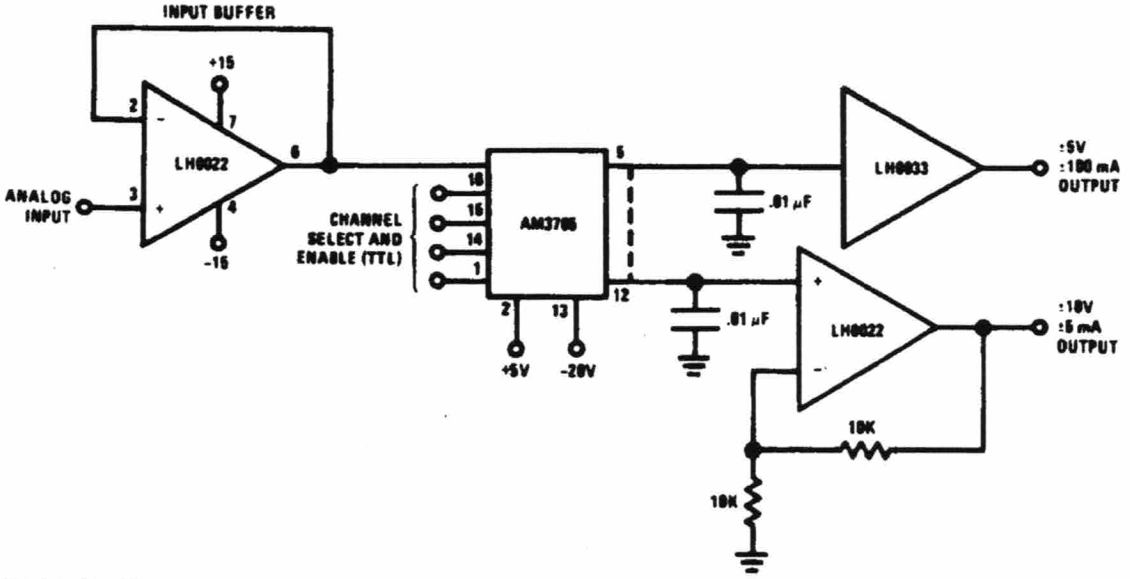
Typical Application (Continued)

8-Channel Demultiplexer with Sample and Hold



Drift Rate-20 mV/sec

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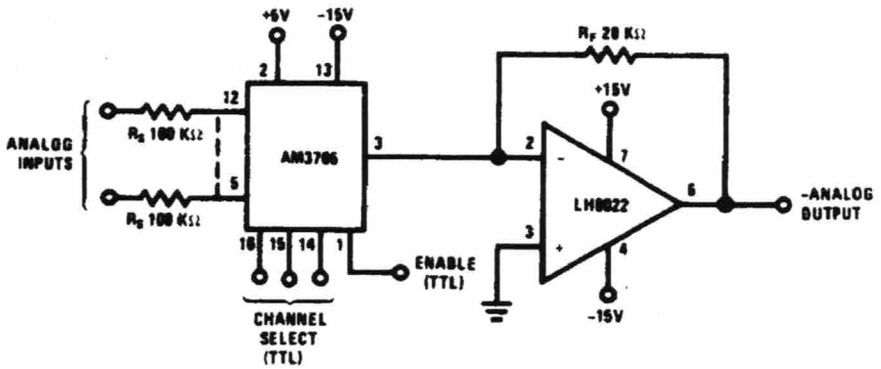
Wide Input Range Analog Switch



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Analog Input Range-25V

Slew Rate - 5 V/μs

Schematic Diagram