

## 16 x 8 x 1 BiMOS-E Crosspoint Switch

The Intersil CD22M3494 is an array of 128 analog switches capable of handling signals from DC to video. Because of the switch structure, input signals may swing through the total supply voltage range,  $V_{DD}$  to  $V_{EE}$ . Each of the 128 switches may be addressed via the ADDRESS input to the 7 to 128 line decoder. The state of the addressed switch is established by the signal to the DATA input. A low or zero input will open the switch, while a high logic level or a one will result in closure of the addressed switch when the STROBE input goes high from its normally low state. Any number or combination of connections may be active at one time. Each connection, however, must be made or broken individually in the manner previously described. All switches may be reset by taking the RESET input from a zero state to a one state and then returning it to its normal low state.

CS allows crosspoint array to be cascaded for matrix expansion.

## Ordering Information

PART NUMBER	TEMP. RANGE (°C)	PACKAGE	PKG. NO.
CD22M3494E	-40 to 85	40 Ld PDIP	E40.6
CD22M3494MQ	-40 to 85	44 Ld PLCC (Mitel Ld Compatible)	N44.65
CD22M3494SQ	-40 to 85	44 Ld PLCC (SGS Ld Compatible)	N44.65

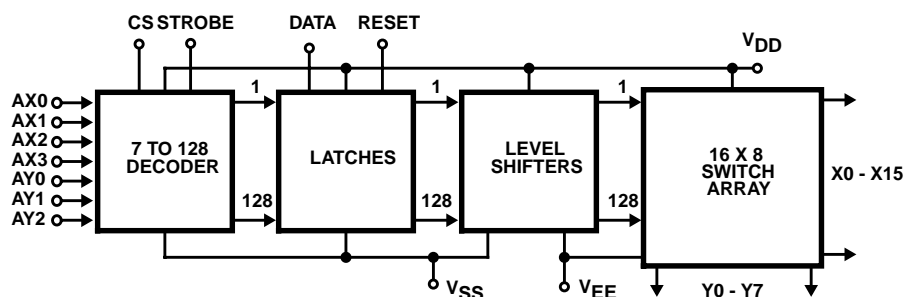
## Features

- 128 Analog Switches
- Low  $R_{ON}$
- Guaranteed  $R_{ON}$  Matching
- Analog Signal Input Voltage Equal to the Supply Voltage
- Wide Operating Voltage . . . . . 4V to 15V
- Parallel Input Addressing
- High Latch Up Current . . . . . 50mA (Min)
- Very Low Crosstalk
- Pin and Functionally Compatible with the Following Types:  
SGS M3494 and Mitel MT8816

## Applications

- PBX Systems
- Instrumentation
- Analog and Digital Multiplexers
- Video Switching Networks

## Block Diagram



**Absolute Maximum Ratings**

DC Supply Voltage ( $V_{DD}$ )	
Voltages Referenced to $V_{EE}$ . . . . .	-0.5 to 16V
DC Supply Voltage ( $V_{DD}$ )	
Voltages Referenced to $V_{SS}$ . . . . .	-0.5, 16V
DC Input Diode Current, $I_{IN}$	
For $V_I$ , Digital < $V_{SS}$ -0.5V or $V_I$ ,	
Analog < $V_{EE}$ -0.5V or $V_I$ > $V_{DD}$ 0.5V . . . . .	$\pm 20$ mA
DC Output Diode Current, $I_{OK}$	
For $V_O$ , Digital < $V_{SS}$ -0.5V or $V_O$ ,	
Analog < $V_{EE}$ -0.5V or $V_O$ > $V_{DD}$ 0.5V . . . . .	$\pm 20$ mA
DC Transmission Gate Current . . . . .	$\pm 25$ mA
Power Dissipation Per Package ( $P_o$ )	
For $T_A$ = -40°C to 85°C (PDIP) . . . . .	500mW
For $T_A$ = 60°C to 85°C Derate Linearly . . . . .	12mW/°C to 200mW
For $T_A$ = -40°C to 85°C (PLCC) . . . . .	600mW

**Thermal Information**

Thermal Resistance (Typical, Note 1)	$\theta_{JA}$ (°C/W)
PDIP Package . . . . .	55
PLCC Package . . . . .	43
Maximum Junction Temperature Plastic Package . . . . .	150°C
Maximum Storage Temperature Range ( $T_{STG}$ ) . . . . .	-65°C to 150°C
Maximum Lead Temperature (Soldering 10s) . . . . .	300°C
(PLCC - Lead Tips Only)	

**Operating Conditions**

Operating Temperature Range ( $T_A$ )	
Package Type E and Q . . . . .	-40°C to 85°C
Supply Voltage Range	
For $T_A$ = Full Package Temperature Range	
$V_{SS}$ = 0V, $V_{EE}$ = 0V, $V_{DD}$ . . . . .	4V to 15V
DC Input or Output Voltage $V_I$ or $V_O$ . . . . .	$V_{EE}$ to $V_{DD}$
Digital Input Voltage . . . . .	$V_{SS}$ to $V_{DD}$

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

**NOTE:**

1.  $\theta_{JA}$  is measured with the component mounted on an evaluation PC board in free air.

**Electrical Specifications**  $T_A$  = -40°C to 85°C,  $V_{DD}$  = 5V,  $V_{SS}$  = 0V,  $V_{EE}$  = 0V, Unless Otherwise Specified

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS
<b>STATIC CONTROLS</b>						
Supply Current	$I_{DD}$	$V_{DD}$ = 5V, Logic Inputs = $V_{DD}$	-	-	2	mA
		$V_{DD}$ = 15V, Logic Inputs = $V_{DD}$	-	-	5	mA
High-Level Input Voltage	$V_{IH}$	$V_{DD}$ = 5V	2.4 (Note 2)	-	-	V
Low-Level Input Voltage	$V_{IL}$		-	-	0.8 (Note 2)	V
Input Leakage Current, Digital	$I_{IN}$	Reset = Low (Note 3)	-	-	$\pm 10$ (Note 4)	$\mu$ A

**Electrical Specifications**  $T_A$  = -40°C to 85°C,  $V_{DD}$  = 12V,  $V_{SS}$  = 0V,  $V_{EE}$  = 0V, Unless Otherwise Specified

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS
<b>STATIC CROSSPOINTS</b>						
ON Resistance	$R_{ON}$	$V_{SS} = V_{EE} = 0V$ , $T_A = 25^\circ C$ , $V_{IN} = V_{DD}/2$ , $V_X$ - $V_Y = 0.2V$	$V_{DD} = 10V$	-	40	75 $\Omega$
			$V_{DD} = 12V$	-	36	65 $\Omega$
ON Resistance	$R_{ON}$	$T_A = -40^\circ C$ to $85^\circ C$ , $V_{IN} = V_{DD}/2$ , $V_X - V_Y = 0.2V$ , $V_{SS} = V_{EE} = 0V$	$V_{DD} = 10V$	-	50	75 $\Omega$
			$V_{DD} = 12V$	-	45	65 $\Omega$
Difference in ON Resistance Between Any Two Switches	$\Delta R_{ON}$	$T_A = 25^\circ C$ , $V_{IN} = V_{DD}/2$ , $V_X - V_Y = 0.2V$ , $V_{SS} = V_{EE} = 0V$ , $V_{DD} = 12V$	-	6	10	$\Omega$

**Electrical Specifications**  $T_A = -40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ ,  $V_{DD} = 12\text{V}$ ,  $V_{SS} = 0\text{V}$ ,  $V_{EE} = 0\text{V}$ , Unless Otherwise Specified (Continued)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Difference in ON Resistance Between Any Two Switches	$\Delta R_{ON}$	$T_A = -40^{\circ}\text{C}$ to $85^{\circ}\text{C}$ , $V_{IN} = V_{DD}/2$ , $V_X - V_Y = 0.2\text{V}$ , $V_{DD} = 12\text{V}$ $V_{SS} = V_{EE} = 0\text{V}$ , $V_{DD} = 12\text{V}$	-	-	10	$\Omega$
OFF-State Leakage Current	$I_L$	$ V_X - V_Y  = 12\text{V}$	-	-	$\pm 10$ (Note 4)	$\mu\text{A}$

**Electrical Specifications**  $T_A = 25^{\circ}\text{C}$ ,  $V_{SS} = 0\text{V}$ ,  $V_{EE} = 0\text{V}$ ,  $V_{DD} = 14\text{V}$ ,  $C_L = 50\text{pF}$ , Unless Otherwise Specified

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
<b>DYNAMIC CROSSPOINTS</b>					
Switch I/O Capacitance	$V_{IN} = V_{DD}/2$ , $f = 1\text{MHz}$	-	-	20	$\text{pF}$
Switch Feedthrough Capacitance	$V_{IN} = V_{DD}/2$ , $f = 1\text{MHz}$	-	0.3	-	$\text{pF}$
Propagation Delay Time (Switch ON) Signal Input to Output, $t_{PHL}$ or $t_{PLH}$		-	5	30	$\text{ns}$
Frequency Response Channel ON $f = 20\log(V_X/V_Y) = -3\text{dB}$	$C_L = 3\text{pF}$ , $R_L = 75\Omega$ , $V_{IN} = 2V_{P-P}$	-	50	-	$\text{MHz}$
Total Harmonic, THD	$V_{IN} = 2V_{P-P}$ , $f = 1\text{kHz}$	-	0.01	-	%
Feedthrough Channel OFF Feedthrough = $20\log(V_X/V_Y) = F_{DT}$	$V_{IN} = 2V_{P-P}$ , $f = 1\text{kHz}$	-	-95	-	$\text{dB}$
Frequency for Signal Crosstalk, $f_{CT}$ Attenuation of:	40dB $V_{IN} = 2V_{P-P}$ , $R_L = 75\Omega$	-	10	-	$\text{MHz}$
	110dB $V_{IN} = 2V_{P-P}$ , $R_L = 1\text{k}\Omega \parallel 10\text{pF}$	-	5	-	$\text{kHz}$
Control Crosstalk DATA-Input, ADDRESS, or STROBE to Output	Control Input = $3V_{P-P}$ Square Wave, $t_R = t_F = 10\text{ns}$ $R_{IN} = 1\text{k}\Omega$ , $R_{OUT} = 10\text{k}\Omega \parallel 10\text{pF}$	-	75	-	$\text{mV}_{PEAK}$

**Electrical Specifications**  $T_A = 25^{\circ}\text{C}$ ,  $V_{SS} = 0\text{V}$ ,  $V_{EE} = 0\text{V}$ ,  $V_{DD} = 14\text{V}$ ,  $R_L = 1\text{k}\Omega \parallel 50\text{pF}$ , Unless Otherwise Specified

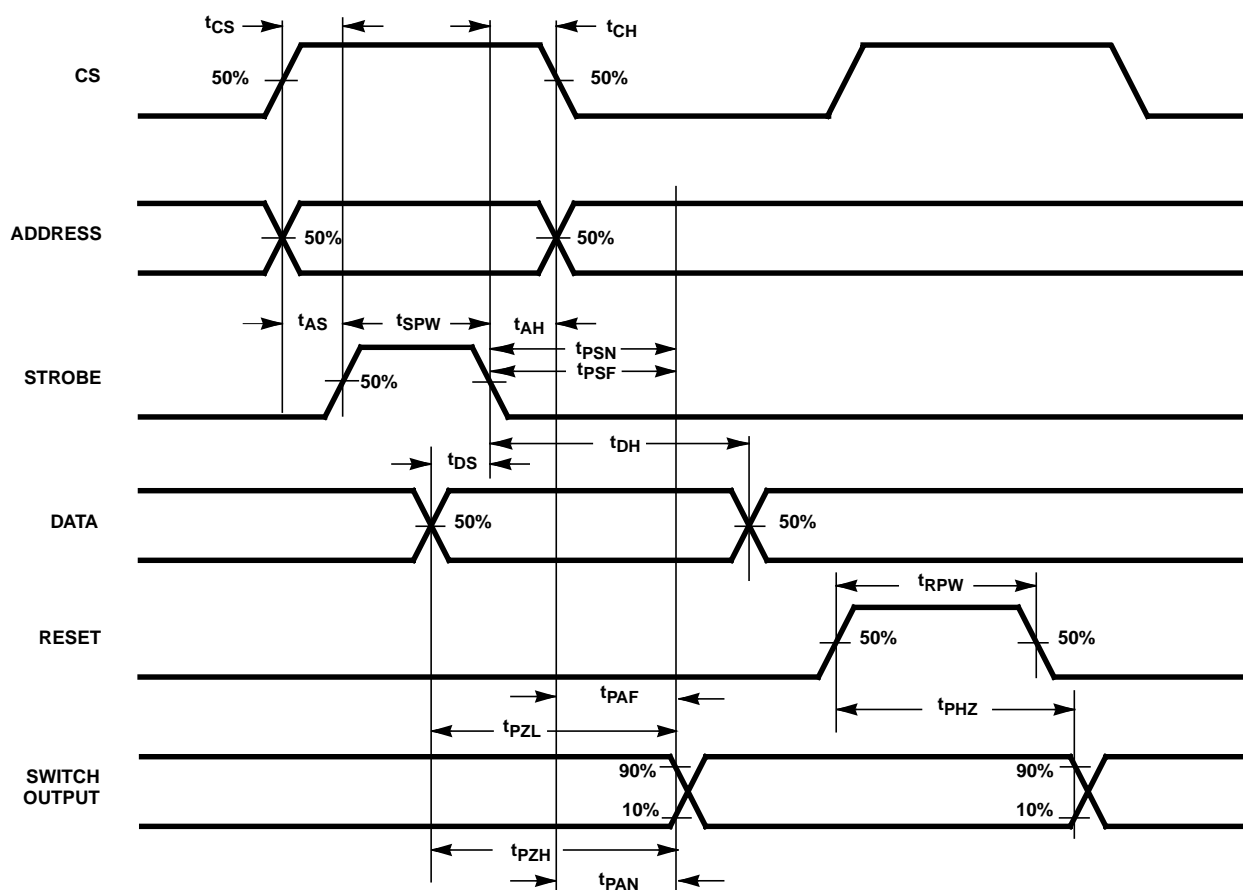
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS
DYNAMIC CONTROLS						
Digital Input Capacitance	C <sub>IN</sub>	V <sub>IN</sub> = 5V, f = 1MHz	-	5	-	pF
Propagation Delay Time STROBE to Output						
Switch Turn-ON	t <sub>PSN</sub>		-	50	100	ns
Switch Turn-OFF	t <sub>PSF</sub>		-	50	100	ns
DATA-IN to Output						
Turn-ON to High Level	t <sub>PZH</sub>		-	60	100	ns
Turn-ON to Low Level	t <sub>PZL</sub>		-	70	100	ns
ADDRESS to Output						
Turn-ON to High Level	t <sub>PAN</sub>		-	70	-	ns
Turn-OFF to Low Level	t <sub>PAF</sub>		-	70	-	ns

**Electrical Specifications**  $T_A = 25^\circ\text{C}$ ,  $V_{SS} = 0\text{V}$ ,  $V_{EE} = 0\text{V}$ ,  $V_{DD} = 14\text{V}$ ,  $R_L = 1\text{k}\Omega \parallel 50\text{pF}$ , Unless Otherwise Specified **(Continued)**

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Setup Time						
CS to STROBE	$t_{CS}$		10	-	-	ns
DATA-IN to STROBE	$t_{DS}$		10	-	-	ns
ADDRESS to STROBE	$t_{AS}$		10	-	-	ns
Hold Time						
STROBE to CS	$t_{CH}$		10	-	-	ns
ADDRESS to CS			10	-	-	ns
STROBE to DATA-IN	$t_{DH}$		20	-	-	ns
STROBE to ADDRESS	$t_{AH}$		10	-	-	ns
DATA-IN to CS			20	-	-	ns
Pulse Width						
STROBE	$t_{SPW}$		20	-	-	ns
RESET	$t_{RPW}$		20	-	-	ns
RESET Turn-OFF to Output Delay	$t_{PHZ}$		-	70	100	ns

**NOTES:**

- Operation of  $V_{IH}$  at 2.4V or  $V_{IL}$  at 0.8V will result in much higher supply current ( $I_{DD}$ ) than for logic inputs equal to  $V_{DD}$  or  $V_{SS}$  respectively.
- Reset  $I_{IH} < 20\mu\text{A}$ , Reset =  $V_{IH}$ .
- At  $25^\circ\text{C}$  Limit is  $\pm 100\text{nA}$ .

**Timing Diagram**

TRUTH TABLE X AXIS

X ADDRESS				
AX3	AX2	AX1	AX0	X SWITCH
0	0	0	0	X0
0	0	0	1	X1
0	0	1	0	X2
0	0	1	1	X3
0	1	0	0	X4
0	1	0	1	X5
0	1	1	0	X12
0	1	1	1	X13
1	0	0	0	X6
1	0	0	1	X7
1	0	1	0	X8
1	0	1	1	X9
1	1	0	0	X10
1	1	0	1	X11
1	1	1	0	X14
1	1	1	1	X15

TRUTH TABLE Y AXIS

Y ADDRESS			
AY2	AY1	AY0	Y SWITCH
0	0	0	Y0
0	0	1	Y1
0	1	0	Y2
0	1	1	Y3
1	0	0	Y4
1	0	1	Y5
1	1	0	Y6
1	1	1	Y7

To make a connection (close switch) between any two points, specify an "X" address, a "Y" address, set "DATA" high, and switch "STROBE" from low to high. To break a connection, follow this same procedure with "DATA" low.

Example:

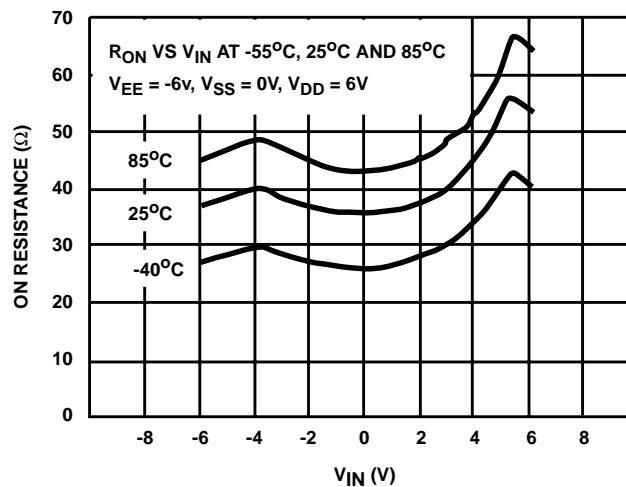
To connect switch X3 to switch Y4:

To connect switch X6 to switch Y7:

To break connection from X3 to Y4:

DATA	X ADDRESS				Y ADDRESS		
	AX3	AX2	AX1	AX0	AY2	AY1	AY0
1	0	0	1	1	1	0	0
1	1	0	0	0	1	1	1
0	0	0	1	1	1	0	0

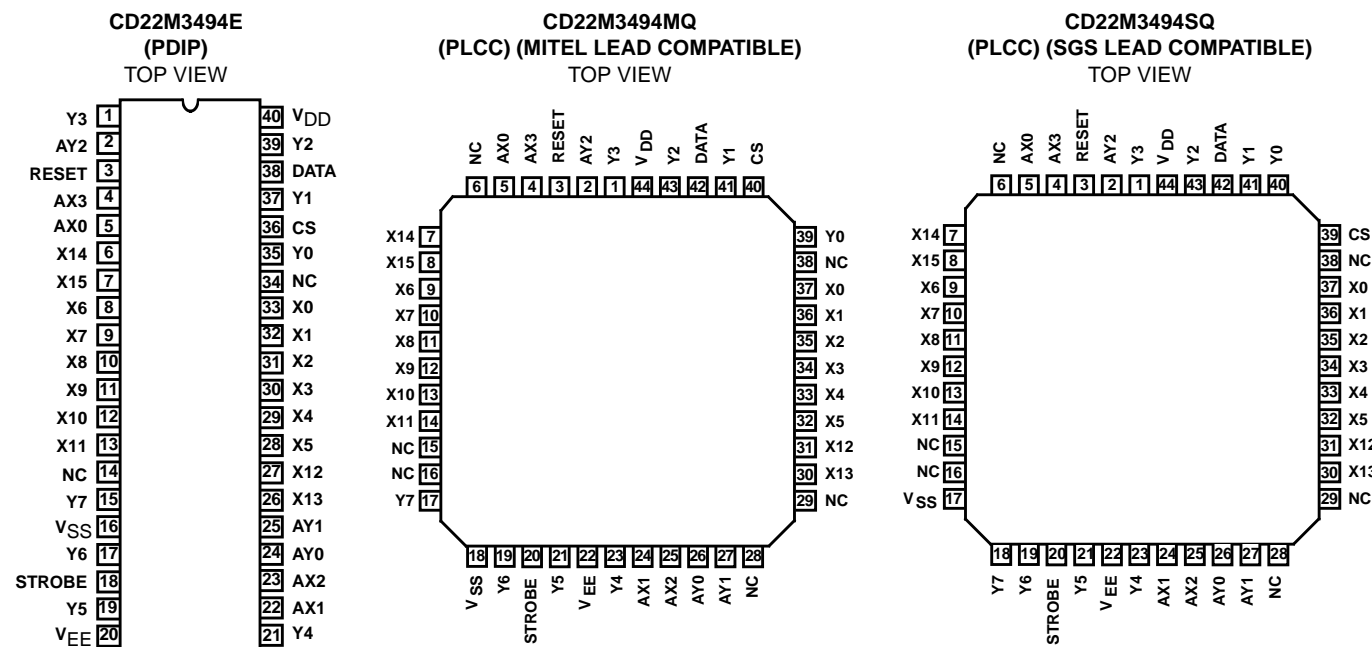
## Typical Performance Curve



## Pin Descriptions

SYMBOL	40 LEAD PDIP PIN NO.	44 LEAD PLCC PIN NO.		DESCRIPTION
		MQ	SQ	
POWER SUPPLIES				
V <sub>DD</sub>	40	44	44	Positive Supply
V <sub>SS</sub>	16	18	17	Negative Supply (Digital)
V <sub>EE</sub>	20	22	22	Negative Supply (Analog)
ADDRESS				
AX0 - AX3	5, 22, 23 and 4	5, 24, 25 and 4		X Address Lines. These pins select one of the 16 rows of switches. See the Truth Table for the valid addresses.
AY0 - AY2	24, 25 and 2	26, 27 and 2		Y Address Lines. These pins select one of the 8 columns of switches. See the Truth Table for the valid addresses.
CONTROL				
DATA	38	42		DATA Input determines the state of the addressed switch. A high or one will close the switch. A low or zero will open the switch.
STROBE	18	20		STROBE Input enables the action defined by the DATA and ADDRESS Inputs. A low or zero results in no action. The ADDRESS Input must be stable before the STROBE Input goes to the active high level. The DATA Input must be stable on the falling edge of the STROBE.
RESET	3	3		MASTER RESET. A high or one on this line opens all switches.
CS	36	40	39	CHIP SELECT. Device is selected when CS is at a high level, allows the crosspoint array to be cascaded for matrix expansion.
INPUTS/OUTPUTS				
X0 - X5 X6 - X11 X12 - X15	33 - 28, 8 - 13, 27, 26, 6, 7	37 - 32 9 - 14, 31, 30, 7, 8		Analog or Digital Inputs/Outputs. These pins are the rows X0 - X15.
Y0 - Y7 I/O	35, 37, 39, 1, 21, 19, 17 and 15	40, 41, 43, 1, 23, 21, 19 and 18		Analog or Digital Inputs/Outputs. These pins are the columns Y0 - Y7.

## Pinouts



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