

**4 X 4 X 2 CROSSPOINT SWITCHES  
WITH CONTROL MEMORY**

- LOW ON RESISTANCE – 75 Ω TYP AT  $V_{DD} = 12\text{ V}$
- "BUILT-IN" LATCHED INPUTS
- LARGE ANALOG SIGNAL CAPACITY  $\pm V_{DD}/2$
- 10 MHz SWITCH BANDWIDTH
- MATCHED SWITCH CHARACTERISTICS
- $\Delta RON = 8\ \Omega$  TYP, AT  $V_{DD} = 12\text{ V}$
- HIGH LINEARITY – 0.25 % DISTORTION TYP, AT  $f = 1\text{ kHz}$ ,  $V_{IN} = 5\text{ V}$ ,  $V_{DD} - V_{SS} = 10\text{ V}$  AND  $RI = 1\ \Omega$
- STANDARD CMOS NOISE IMMUNITY

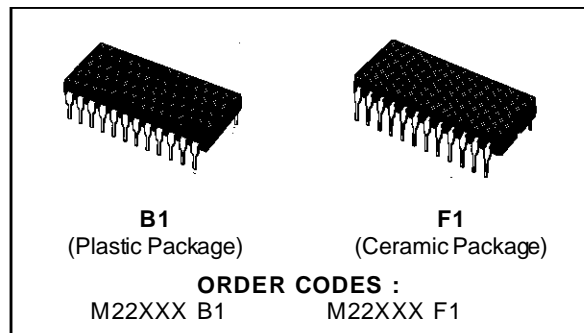
**DESCRIPTION**

The **M22101** and **M22102** crosspoint switches consist of 4 x 4 x 2 arrays of crosspoints (transmission gates), 4-line to 16-line decoders, and 16 latch circuits. Any one of the sixteen crosspoint pairs can be selected by applying the appropriate four-line address and any number of crosspoint pairs can be ON simultaneously. Corresponding crosspoints in each array are turned on and OFF simultaneously, also.

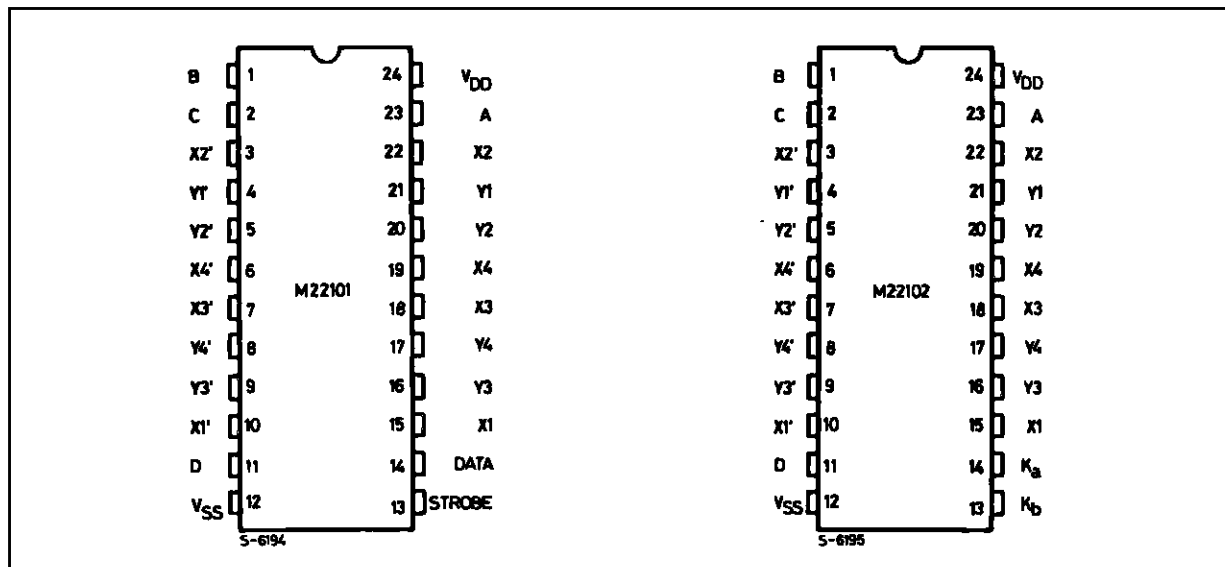
In the **M22101**, the selected crosspoint pair can be turned on or off by applying a logical ONE or ZERO, respectively, to the data input, and applying a ONE to the strobe input. When the device is "power-up", the state of the 16 switches is indeterminate.

Therefore all switches must be turned off by putting the strobe high, data-in-low, and the addressing all switches in succession.

The selected pair of crosspoints in the **M22102** is turned on by applying a logical ONE to the  $K_a$  (set) input while a logical ZERO is on the  $K_b$  (reset) input, and turned off by applying a logical ONE to the  $K_b$  input while a logical ZERO is on the  $K_a$  input. In this respect the control latches of the **M22102** are similar to SET/RESET flip-flops. They differ, however, in that the simultaneous application of ONES to the  $K_a$  and  $K_b$  inputs turns off (resets) all crosspoints. All crosspoints in both devices must be turned off as  $V_{DD}$  is applied.



**PIN CONNECTIONS**



**ABSOLUTE MAXIMUM RATING**

Symbol	Parameter	Value	Unit
V <sub>DD</sub>	Supply Voltage: Ceramic Type Plastic Type	-0.5 to +20	V
		-0.5 to +18	V
V <sub>i</sub>	Input Voltage	-0.5 to V <sub>DD</sub> + 0.5	V
I <sub>I</sub>	DC Input Current (any one input)	± 10	mA
P <sub>tot</sub>	Total Power Dissipation (per package) Dissipation per Output Transistor for Top = Full Package Temperature Range	200	mW
		100	mW
T <sub>op</sub>	Operating Temperature: Ceramic Type Plastic Type	-55 to +125	°C
		-40 to +85	°C
T <sub>stg</sub>	Storage Temperature	-65 to +150	°C

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

**RECOMMENDED OPERATING CONDITIONS**

Symbol	Parameter	Value	Unit
V <sub>DD</sub>	Supply Voltage: Ceramic Type Plastic Type	3 to 18	V
		3 to 15	V
V <sub>i</sub>	Input Voltage	0 to V <sub>DD</sub>	V
T <sub>op</sub>	Operating Temperature: Ceramic Type Plastic Type	-55 to +125	°C
		-40 to +85	°C

**CONTROL TRUTH TABLE FOR M22101**

Function	Address				Strobe	Data	Select
	A	B	C	D			
Switch-on	1	1	1	1	1	1	(X4 Y4) & (X4' Y4')
Switch-off	1	1	1	1	1	0	(X4 Y4) & (X4' Y4')
No Change	X	X	X	X	0	X	X X X X

Note: 1 = High, 0 = Low, X = Don't Care

**CONTROL TRUTH TABLE FOR M22102**

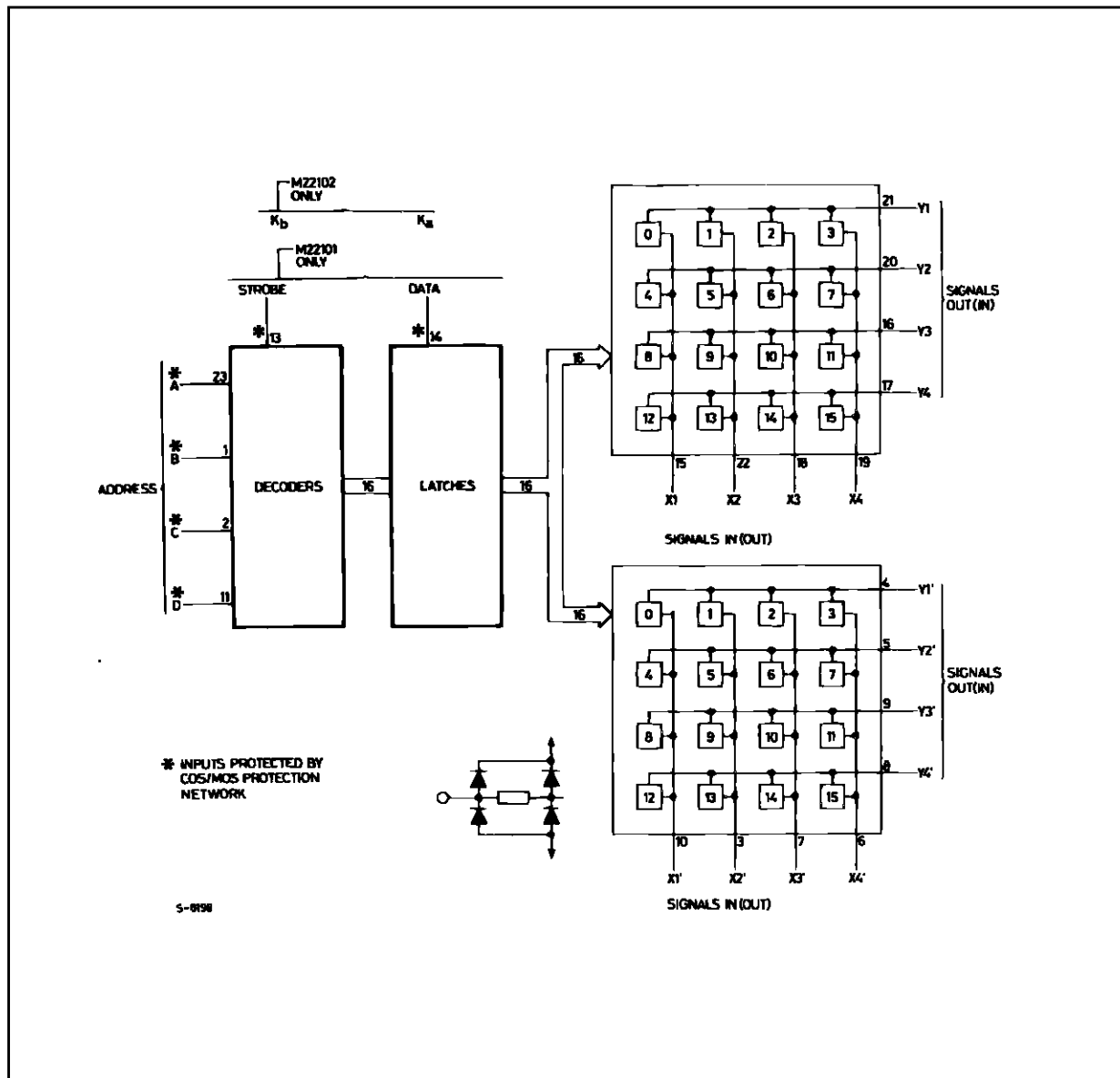
Function	Address				Strobe	Data	Select
	A	B	C	D			
Switch-on	1	1	1	1	1	0	(X4 Y4) & (X4' Y4')
Switch-off	1	1	1	1	0	1	(X4 Y4) & (X4' Y4')
All Switch-off	X	X	X	X	1	1	All
No Change	X	X	X	X	0	0	X X X X

Note: 1 = High, 0 = Low, X = Don't Care

DECODER TRUTH TABLE

Address				Select		Address				Select	
A	B	C	D			A	B	C	D		
0	0	0	0	X1 Y1	X1' Y1'	0	0	0	1	X1 Y3	X1' Y3'
1	0	0	0	X2 Y1	X2' Y1'	1	0	0	1	X2 Y3	X2' Y3'
0	1	0	0	X3 Y1	X3' Y1'	0	1	0	1	X3 Y3	X3' Y3'
1	1	0	0	X4 Y1	X4' Y1'	1	1	0	1	X4 Y3	X4' Y3'
0	0	1	0	X1 Y2	X1' Y2'	0	0	1	1	X1 Y4	X1' Y4'
1	0	1	0	X2 Y2	X2' Y2'	1	0	1	1	X2 Y4	X2' Y4'
0	1	1	0	X3 Y2	X3' Y2'	0	1	1	1	X3 Y4	X3' Y4'
1	1	1	0	X4 Y2	X4' Y2'	1	1	1	1	X4 Y4	X4' Y4'

FUNCTIONAL AND BLOCK DIAGRAM



**STATIC ELECTRICAL CHARACTERISTICS** (over recommended operating conditions)

Symbol	Parameter	Test Conditions				Value						Unit				
			V <sub>I</sub> (V)	V <sub>DD</sub> (V)	T <sub>LOW</sub> *		25 °C			T <sub>HIGH</sub> *						
					Min.	Max.	Min.	Typ.	Max.	Min.	Max.					
<b>CROSSPOINT</b>																
I <sub>L</sub>	Quiescent Supply Current	F1		5				0.04	5		150	μA				
				10				0.04	10		300					
				15				0.04	20		600					
				20				0.08	100		3000					
		B1		5				0.04	20		150					
				10				0.04	40		300					
R <sub>ON</sub>	On Resistance	F1	Any Switch	5		450		225	1250		1625	Ω				
				10		135		85	180		230					
				12		100		75	135		175					
				15		70		65	95		125					
		B1		V <sub>IS</sub> = 0 to V <sub>DD</sub>	5		1000		225	1250			1440			
					10		145		85	180			205			
					12		110		75	135			155			
					15		75		65	95			110			
		ΔON			Resistance ΔR <sub>ON</sub> (Between any two channels)			5					35			Ω
								10					20			
								12					18			
								15					15			
OFF Channel Leakage Current		F1	All Switch OFF		0/18	18		±0.1		±10 <sup>-3</sup>	±0.1•		±1	μA		
		B1			0/15	15		±0.3		±10 <sup>-3</sup>	±0.3		±1			
<b>CONTROL</b>																
V <sub>IL</sub>	Input Low Voltage		OFF Switch I <sub>L</sub> < 0.2 μA		5		1.5			1.5		1.5	V			
				10		3			3		3					
				15		4			4		4					
V <sub>IH</sub>	Input High Voltage		ON Switch see R <sub>ON</sub> Characteristics	5	3.5		3.5				3.5	V				
				10	7		7			7						
				15	11		11			11						
I <sub>I</sub>	Input Current	F1	Any Control Input	0/18	18		±0.1		±10 <sup>-5</sup>	±0.1		±1	μA			
		B1		0/15	15		±0.3		±10 <sup>-5</sup>	±0.3		±1				
C <sub>I</sub>	Input Capacitance		Any Input					5	7.5			pF				

• Determined by minimum feasible leakage measurement for automatic testing

\* T<sub>LOW</sub> = -55 °C for HCC device; -40 °C for HCF device.

\* T<sub>HIGH</sub> = +125 °C for HCC device; +85 °C for HCF device.

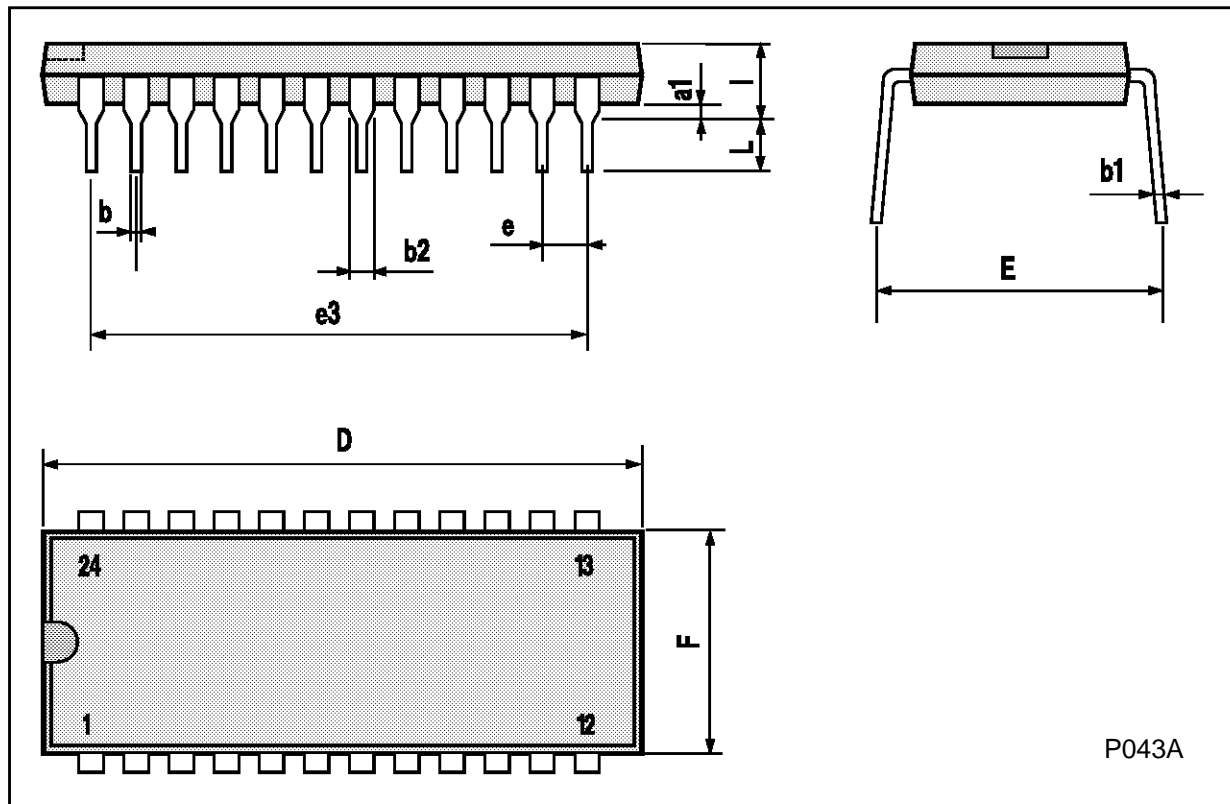
The Noise Margin for both "1" and "0" level is: 1V min. with V<sub>DD</sub> = 5V, 2V min. with V<sub>DD</sub> = 10V, 2.5V min. with V<sub>DD</sub> = 15V

**DYNAMIC ELECTRICAL CHARACTERISTICS** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ ,  $C_L = 50\text{ pF}$ ,  $R_L = 200\text{ K}\Omega$ , typical temperature coefficient for all  $V_{DD}$  values is  $03\text{ }^{\circ}\text{C}$ , all input rise and fall times =  $20\text{ ns}$ )

Symbol	Parameter	Test Conditions		Value			Unit
			$V_{DD}$ (V)	Min.	Typ.	Max.	
$t_{PHL}$ $t_{PLH}$	Propagation Delay Time Address or Strobe Inputs to Output	$R_L = 10\text{ K}\Omega$ $C_L = 50\text{ pF}$	12		200		ns
$t_{PHL}$ $t_{PLH}$	Propagation Delay Time Across Crosspoint				20		ns
	Minimum Strobe Pulse Width				80		ns

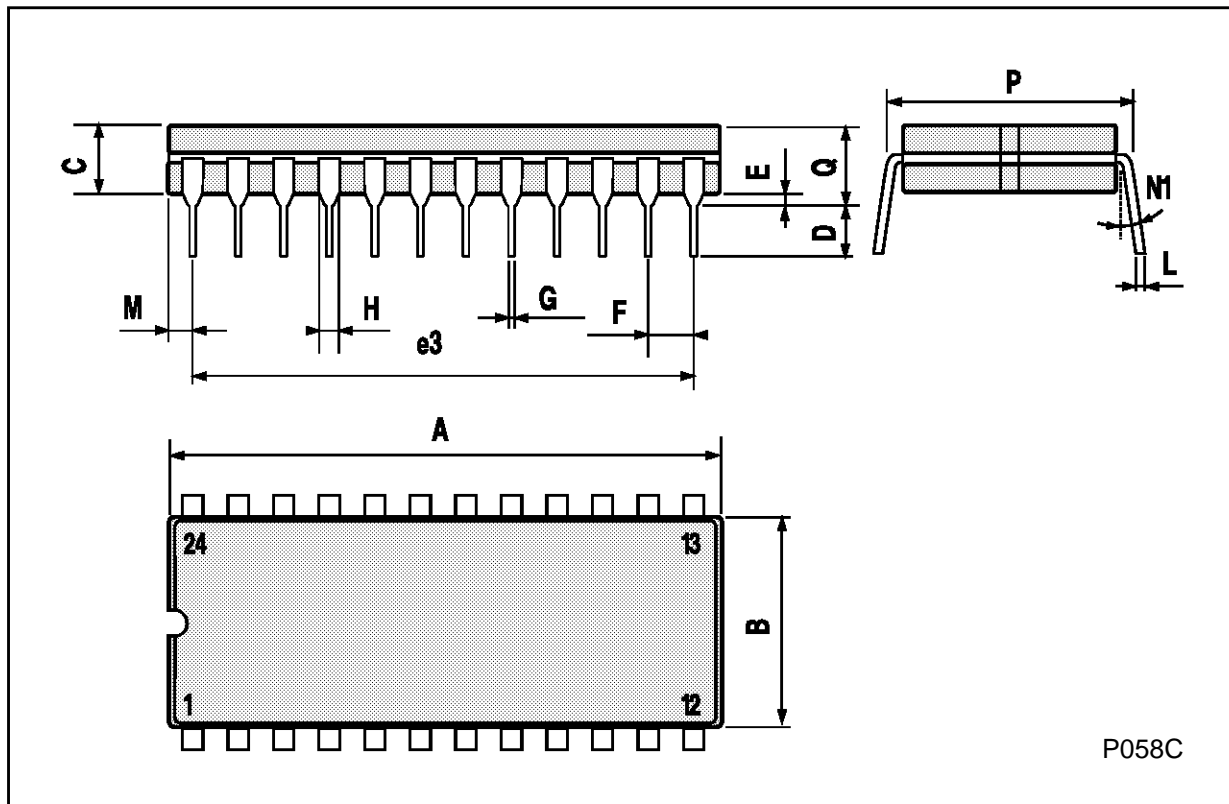
**Plastic DIP24 (0.25) MECHANICAL DATA**

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1		0.63			0.025	
b		0.45			0.018	
b1	0.23		0.31	0.009		0.012
b2		1.27			0.050	
D			32.2			1.268
E	15.2		16.68	0.598		0.657
e		2.54			0.100	
e3		27.94			1.100	
F			14.1			0.555
l		4.445			0.175	
L		3.3			0.130	



**Ceramic DIP24 MECHANICAL DATA**

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			32.3			1.272
B	13.05		13.36	0.514		0.526
C	3.9		5.08	0.154		0.200
D	3			0.118		
E	0.5		1.78	0.020		0.070
e3		27.94			1.100	
F	2.29		2.79	0.090		0.110
G	0.4		0.55	0.016		0.022
I	1.17		1.52	0.046		0.060
L	0.22		0.31	0.009		0.012
M	1.52		2.49	0.060		0.098
N1	4° (min.), 15° (max.)					
P	15.4		15.8	0.606		0.622
Q			5.71			0.225



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