

features

- **Static operation**
- **Nondestructive readout and interrogation**
- **High-speed operation — 250-ns typical system cycle time**
- **Low standby power dissipation**
- **Masked write and interrogation capability**
- **Low threshold technology**

description

The TMS 4000 JC/NC is a high-speed content-addressable memory organized as 16 eight-bit words. The entire device is constructed on a single monolithic chip using low-threshold MOS P-channel enhancement-mode transistors. Active-element design permits nondestructive readout and interrogation of memory contents. Bit lines can be wire-OR connected to obtain memory planes greater than 16 words. Word lines can be wire-OR connected to achieve word lengths of greater than eight bits per word. Selection of a given word for reading or writing is accomplished by connecting the selected word line to a negative voltage while holding all other word lines at ground. The common interrogation control 1, when returning to a negative voltage, allows all sixteen words to be interrogated simultaneously.

Memory writing is accomplished by addressing a desired word and bringing the appropriate bit lines to ground while holding the other bit lines at a negative potential. If both lines of a selected bit are held at the negative potential, the information in the bit will be unchanged during a writing cycle. Masked writing therefore can be achieved.

Reading each bit content of an addressed word requires sensing differential current between the two bit lines. Both lines should be held near a logic 1.

Interrogation of memory content is accomplished by activating the interrogation command I, bringing bit lines to appropriate voltages, and simultaneously sensing the current in each word line. If both bit lines of a particular bit are held at ground potential during an interrogation cycle, that bit will be excluded from the interrogation. If a word perfectly matches the interrogation information, no current will flow through the word lines. One or more mismatches will cause at least 200 μ A to flow in the word line.

"TMS 4000 JC" designates a unit mounted in a 40-pin hermetically sealed dual-in-line package, and "TMS 4000 NC" is the number for a unit mounted in a 40-pin dual-in-line plastic package.

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

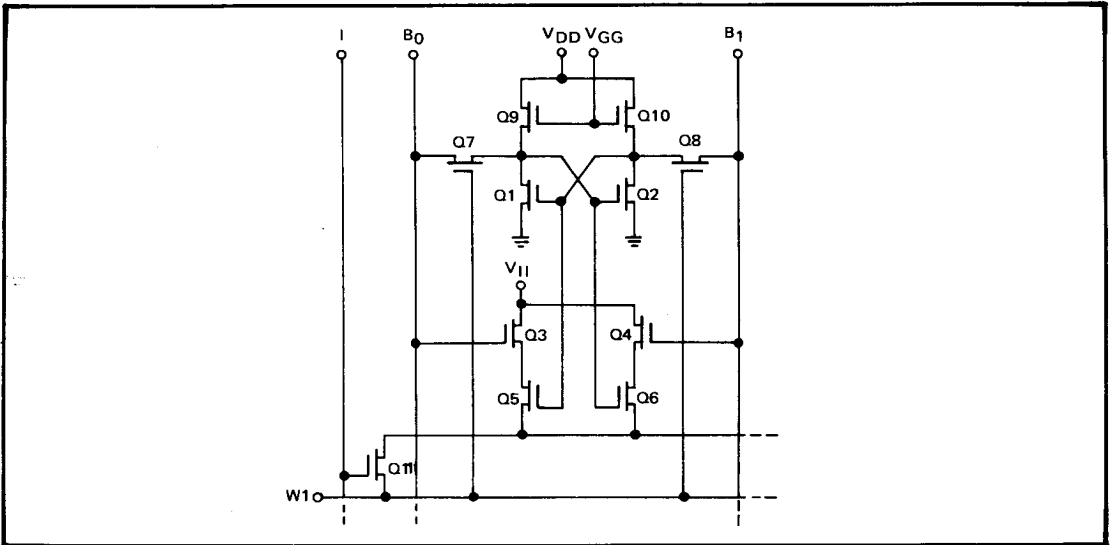
Voltage at any terminal relative to substrate (GND)	+0.3 V to -14 V
Operating free-air temperature range	-25°C to 85°C
Storage temperature range	-55°C to 150°C

recommended operating conditions

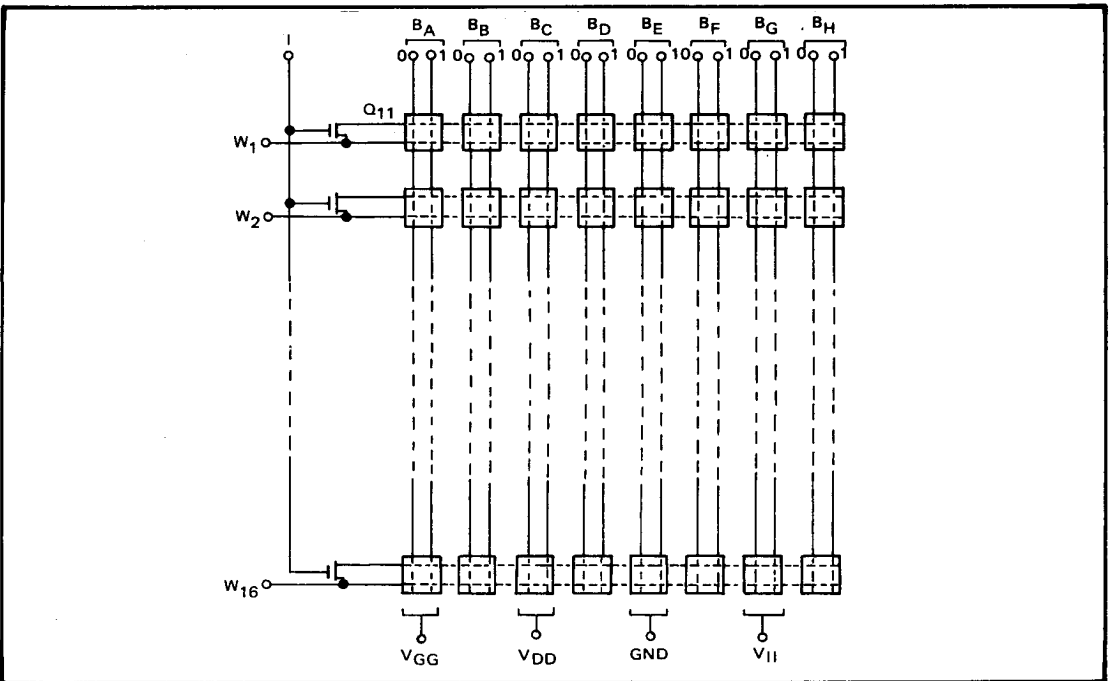
CHARACTERISTICS	MIN	NOM	MAX	UNITS
Supply voltage V_{GG}	-11	-12	-13	V
Supply voltage V_{DD}	-11	-12	-13	V
Supply voltage V_{I1}	2.7	-3	-13	V
Write time (t_{W})	60			ns
Settling time (t_s)	50			ns

TMS 4000 JC, TMS 4000 NC HIGH-SPEED CONTENT-ADDRESSABLE MEMORY

CONTENT-ADDRESSABLE MEMORY CELL



CONTENT-ADDRESSABLE MEMORY ORGANIZATION



TMS 4000 JC, TMS 4000 NC

HIGH-SPEED CONTENT-ADDRESSABLE MEMORY

logic definition

Negative logic is assumed

- a) Logic 1 = most negative voltage
- b) Logic 0 = most positive voltage

OPERATION	INPUT VOLTAGE				OUTPUT SIGNALS
	I	W	B ₀	B ₁	
Write 0	0	1	1	0	
Write 1	0	1	0	1	
Masked Write	0	1	1	1	
Read 0	0	1	1	1	Current in B ₁ (200 μ A minimum)
Read 1	0	1	1	1	Current in B ₀ (200 μ A minimum)
Interrogate 0	1	0	1	0	Current in W indicates mismatch (200 μ A minimum)
Interrogate 1	1	0	0	1	
Masked Interrogate	1	0	0	0	No current in W from this bit
Standby	0	0	X	X	(See Note 1)

NOTE 1: X = 1 or 0 (don't care)

electrical characteristics (under nominal operating conditions at 25°C, unless otherwise noted)

R_L = 100 Ω (See CAM operational requirements)

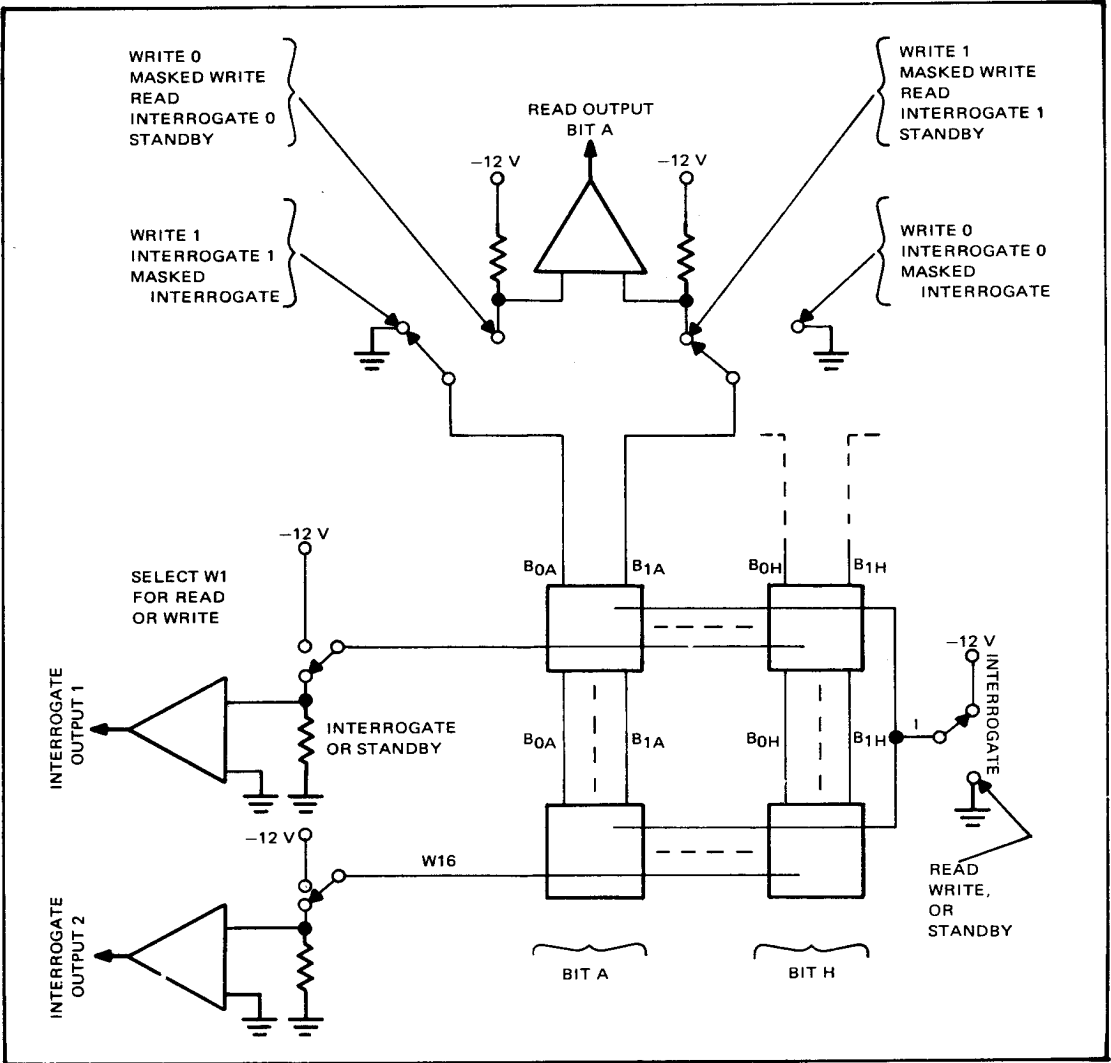
PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Read-mode sense current	Logic 0 stored in a bit cell	B ₀		-10	μ A
		B ₁	-200	-400	
	Logic 1 stored in a bit cell	B ₀	-200	-400	
		B ₁			
Interrogate-mode sense current	Matched			-10	μ A
	One bit mismatched	-200	-400		
	All bits (8) mismatched		-2000	-3000	
I _B	Bit-line leakage current	16 in parallel @ -12 V		10	μ A
I _W	Word-line leakage current	16 in parallel @ -12 V		10	μ A
I _I	Interrogate line leakage current	At -12 V		100	μ A
I _{DD}	Drain supply current			5.0	mA
I _{II}	Interrogation supply current per word	One bit mismatched	-0.2	-0.4	mA
		All bits (8) mismatched		-2.0 -3.0	
Total power dissipation	Standby		40	60	mW
	Read or Write			100	
	Interrogation			200	
C _B	Bit-line capacitance	V _B = 0 V, f = 1 MHz	13		pF
C _W	Word-line capacitance	V _W = 0 V, f = 1 MHz	12		pF
C _I	Interrogate-line capacitance	V _I = 0 V, f = 1 MHz	40		pF

switching characteristics (under nominal operating conditions at 25°C, unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
t _s	Settling time			50	ns
t _{ai}	Interrogate access time		50	80	ns
t _{ar}	Read access time		30	60	ns

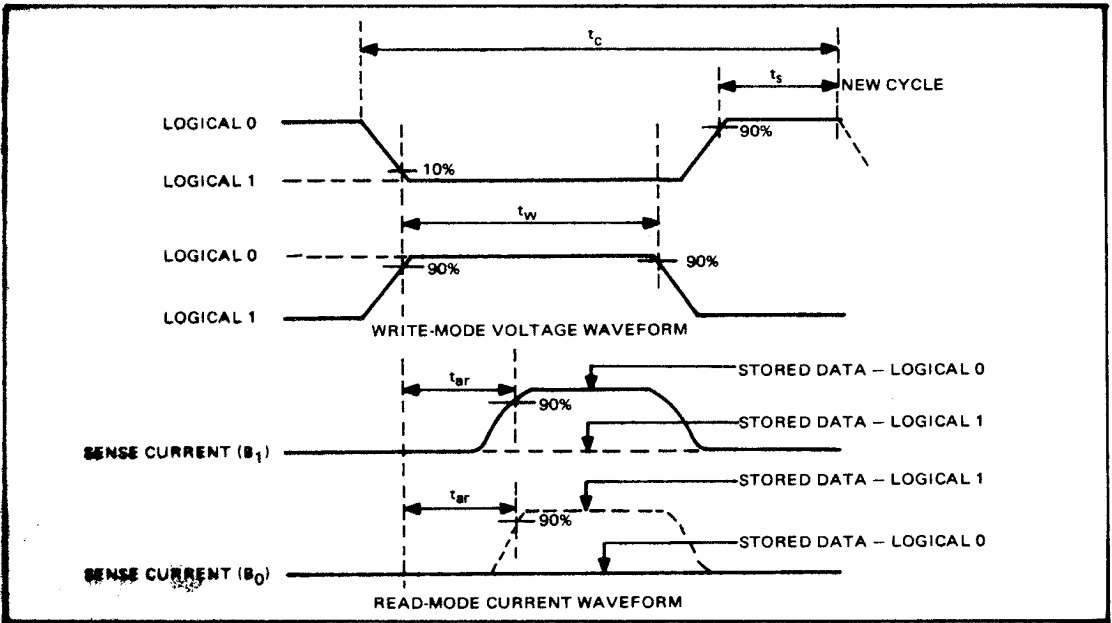
TMS 4000 JC, TMS 4000 NC HIGH-SPEED CONTENT-ADDRESSABLE MEMORY

content-addressable memory operational requirements

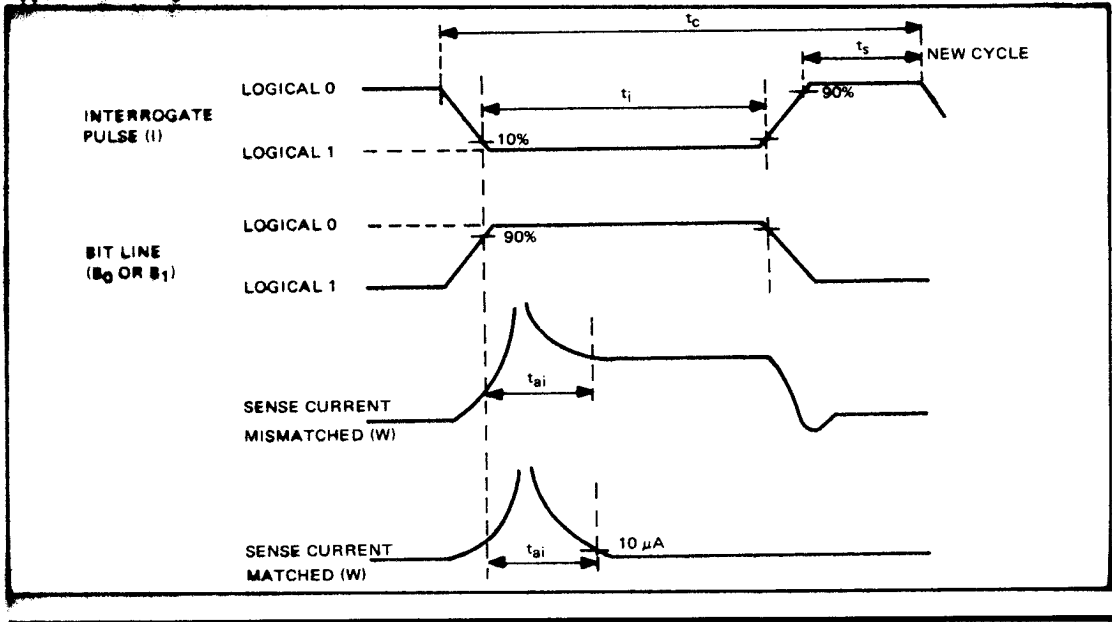


TMS 4000 JC, TMS 4000 NC HIGH-SPEED CONTENT-ADDRESSABLE MEMORY

typical switching waveforms (read and write)



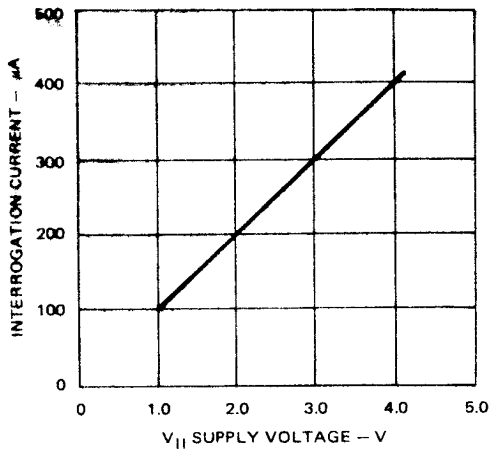
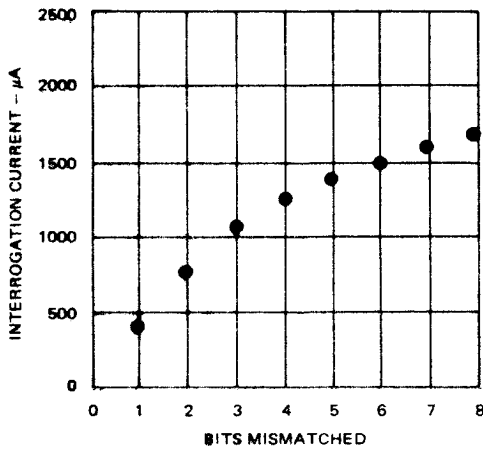
typical switching waveforms (interrogation)



TMS 4000 JC, TMS 4000 NC HIGH-SPEED CONTENT-ADDRESSABLE MEMORY

Interrogation Current vs Number of Bits Mismatched,
And vs V_{II} Supply Voltage

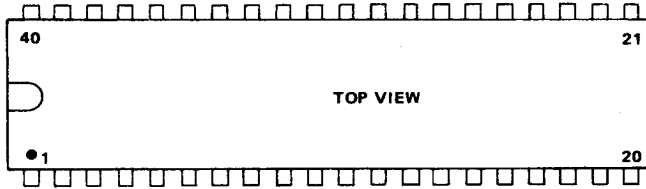
($R = 100 \Omega$, $V_{DD} = -12 \text{ V}$, $V_{GG} = -12 \text{ V}$, Logical 1 = -12 V , $T_A = 25^\circ \text{C}$)



TMS 4000 JC, TMS 4000 NC HIGH-SPEED CONTENT-ADDRESSABLE MEMORY

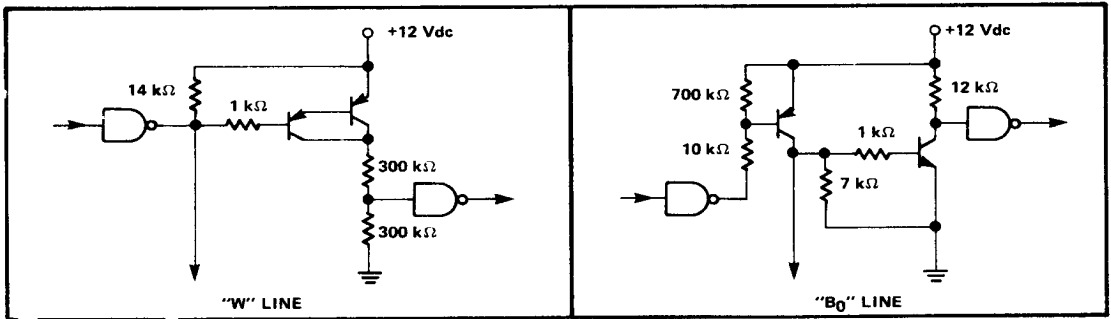
mechanical data and pin configuration

The device is available in both a 40-pin hermetically sealed ceramic dual-in-line package (TMS 4000 JC) and a 40-pin dual-in-line plastic package (TMS 4000 NC). The packages are designed for insertion in mounting-hole rows on 0.600-inch centers.



PIN NO.	FUNCTION	PIN NO.	FUNCTION	PIN NO.	FUNCTION	PIN NO.	FUNCTION
1	0	11	W ₈	21	1	31	W ₉
2	1	12	W ₆	22	0	32	W ₁₁
3	0	13	W ₄	23	1	33	W ₁₃
4	1	14	W ₂	24	0	34	W ₁₅
5	I	15	V _{GG}	25	V _{DD}	35	NC
6	GND	16	NC	26	NC	36	V _{I1}
7	W ₁₆	17	1	27	W ₁	37	0
8	W ₁₄	18	0	28	W ₃	38	1
9	W ₁₂	19	1	29	W ₅	39	0
10	W ₁₀	20	0	30	W ₇	40	1

typical read/write interface for one-microsecond operation



NOTE: All gates = SN7400