SUPPLEMENT

MOSTEK

4096 x 1-BIT DYNAMIC RAM

Processed to MIL-STD-883, Method 5004, Class B

MKB4027(J)-83/84

FEATURES

- Extended operating temperature range ($-55°C \leq T_A \leq +85°C$)
- Industry standard 16-pin DIP (MK4096) configuration
- 200ns access time, 375ns cycle (-83)
  250ns access time, 375ns cycle (-84)
- ± 10% tolerance on all supplies (+12V, ± 5V)
- Low Power: 467mW active (max)
  40mW standby (max)
- Improved performance with "gated $\overline{CAS}$," "$\overline{RAS}$ only" refresh and page mode capability
- All inputs are low capacitance and TTL compatible
- Input latches for addresses, chip select and data in
- Three-state TTL compatible output
- Output data latched and valid into next cycle
- Ruggedized for use in severe military environments

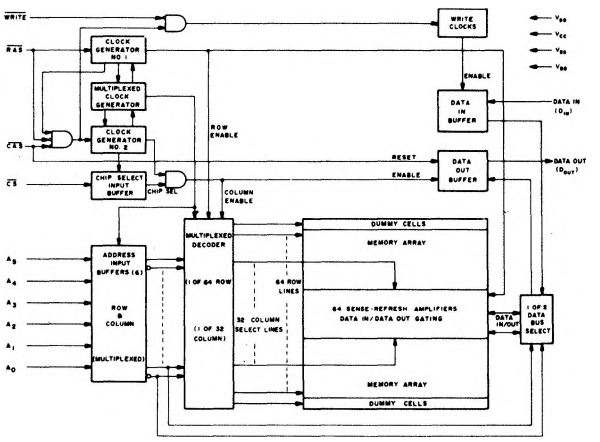
DESCRIPTION

The MKB4027 is a 4096 word by 1 bit MOS random access memory circuit fabricated with Mostek's N-channel silicon gate process. This process allows the MKB4027 to be a high performance state-of-the-art memory circuit that is manufacturable in high volume. The MKB4027 employs a single transistor storage cell utilizing a dynamic storage technique and dynamic control circuitry to achieve optimum performance with low power dissipation.

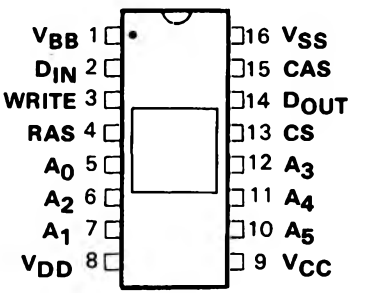
A unique multiplexing and latching technique for the address inputs permits the MKB4027 to be packaged in a standard 16-pin DIP on 0.3 in. centers. This package size provides high system-bit densities and is compatible with widely available automated testing and insertion equipment.

System oriented features include direct interfacing capability with TTL, only 6 very low capacitance address lines to drive, on-chip address and data registers which eliminates the need for interface registers, input logic levels selected to optimize noise immunity, and two chip select methods to allow the user to determine the appropriate speed/power characteristics of his memory system. The MKB4027 also incorporates several flexible operating modes. In addition to the usual read and write cycles, read-modify write, page-mode, and $\overline{RAS}$ only refresh cycles are available with the MKB4027. Page-mode timing is very useful in systems requiring Direct Memory Access (DMA) operation.

FUNCTIONAL DIAGRAM



PIN CONNECTIONS



PIN NAMES

A_0 - A_6	Address Inputs	WRITE	Read/Write Input
CS	Col Address Strobe	V_{BB}	Power (-5V)
D_{IN}	Data In	V_{CC}	Power (+5V)
D_{OUT}	Data Out	V_{DD}	Power (+12V)
RAS	Row Address Strobe	V_{SS}	Ground

ABSOLUTE MAXIMUM RATINGS*

Voltage on any pin relative to V_{BB} ..... -0.5V to +20V
Voltage on V_{DD}, V_{CC} relative to V_{SS} ..... -1.0V to +15V
V_{BB} - V_{SS} (V_{DD} - V_{SS} > 0) 0V
Operating Temperature (Ambient)(Ceramic) ..... -55°C to +85°C
Storage Temperature (Ambient)(Ceramic) ..... -65°C to +150°C
Short Circuit Output Current 50mA
Power Dissipation ..... 1 Watt

*Stresses greater than 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 operating sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

RECOMMENDED DC OPERATING CONDITIONS[4]

(-55°C ≤ T_A ≤ 85°C)

SYM	PARAMETER	MIN	TYP	MAX	UNITS	NOTES
V_{DD}	Supply Voltage	10.8	12.0	13.2	V	2
V_{CC}	Supply Voltage	4.5	5.0	5.5	V	2,3
V_{SS}	Ground	0	0	0	V	2
V_{BB}	Supply Voltage	-4.5	-5.0	-5.5	V	2
V_{IHC}	Logic 1 Voltage, $\overline{RAS}$, $\overline{CAS}$, $\overline{WRITE}$	2.7		7.0	V	2
V_{IH}	Logic 1 Voltage, all inputs except $\overline{RAS}$, $\overline{CAS}$, $\overline{WRITE}$	2.4		7.0	V	2
V_{IL}	Logic 0 Voltage, all inputs	-1.0		.8	V	2

DC ELECTRICAL CHARACTERISTICS[4]

(-55°C ≤ T_A ≤ 85°C)[1] (V_{DD} = 12.0V ± 10%; V_{CC} = 5.0V ± 10%; V_{SS} = 0V; V_{BB} = -5.0V ± 10%)

SYM	PARAMETER	MIN	TYP	MAX	UNITS	NOTES
I_{DD1}	Avg. V_{DD} Power Supply Current			35	mA	5
I_{DD2}	Standby V_{DD} Power Supply Current			3.0	mA	8
I_{DD3}	Avg. V_{DD} Power Supply Current during "$\overline{RAS}$ only" cycles			27	mA	
I_{CC}	V_{CC} Power Supply Current				mA	6
I_{BB}	Avg. V_{BB} Power Supply Current			200	μA	
$I_{I(L)}$	Input Leakage Current (any input)			10	μA	7
$I_{O(L)}$	Output Leakage Current			10	μA	8,9
V_{OH}	Output Logic 1 Voltage @ I_{OUT} = -5mA	2.4			V	
V_{OL}	Output Logic 0 Voltage @ I_{OUT} = 3.2mA			0.4	V	

NOTES:

1. T_A is specified for operation at frequencies to $t_{RC} \geq t_{RC}$(min). Operation at higher cycle rates with reduced ambient temperatures and higher power dissipation is permissible provided that all AC parameters are met.
2. All voltages referenced to V_{SS}.
3. Output voltage will swing from V_{SS} to V_{CC} when enabled, with no output load. For purposes of maintaining data in standby mode, V_{CC} may be reduced to V_{SS} without affecting refresh operations or data retention. However, the V_{OH} (min) specification is not guaranteed in this mode.
4. Several cycles are required after power-up before proper device operation is achieved. Any 8 cycles which perform refresh are adequate for this purpose.
5. Current is proportional to cycle rate. I_{DD1} (max) is measured at the cycle rate specified by t_{RC}(min). See Figure 1 for I_{DD1} limits at other cycle rates.
6. I_{CC} depends on output loading. During readout of high level data V_{CC} is connected through a low impedance (135Ω typ) to Data Out. At all other times I_{CC} consists of leakage currents only.

ELECTRICAL CHARACTERISTICS AND RECOMMENDED AC OPERATING CONDITIONS (4,11,7)
$(-55°C \leq T_A \leq 85°C)^1$ (V_{DD} = 12.0V ± 10%, V_{CC} = 0V, V_{BB} = -5.0V ± 10%)

		MKB4027-83		MKB4027-84			
SYM	PARAMETER	MIN	MAX	MIN	MAX	UNITS	NOTES
t_{RC}	Random read or write cycle time	375		380		ns	12
t_{RWC}	Read-write cycle time	375		395		ns	12
t_{RMW}	Read Modify Write Cycle	405		470		ns	12
t_{PC}	Page mode cycle time	225		285		ns	12
t_{RAC}	Access time from row address strobe		200		250	ns	13,15
t_{CAC}	Access time from column address strobe		135		165	ns	14,15
t_{OFF}	Output buffer turn-off delay		50		60	ns	
t_{RP}	Row address strobe precharge time	120		120		ns	
t_{RAS}	Row address and strobe pulse width	200	5000	250	5000	ns	
t_{RSH}	Row address strobe hold time	135		165		ns	
t_{CAS}	Column address strobe pulse width	135		165		ns	
t_{CSH}	$\overline{CAS}$ hold time	200		250		ns	
t_{RCD}	Row to column strobe delay	25	65	35	85	ns	16
t_{ASR}	Row address set-up time	0		0		ns	
t_{RAH}	Row address hold time	25		35		ns	
t_{ASC}	Column address set-up time	0		0		ns	
t_{CAH}	Column address hold-time	55		75		ns	
t_{AR}	Column address hold time referenced to $\overline{RAS}$	120		160		ns	
t_{CSC}	Chip select set-up time	0		0		ns	
t_{CH}	Chip select hold time	55		75		ns	
t_{CHR}	Chip select hold time referenced to $\overline{RAS}$	120		160		ns	
t_T	Transition time (rise and fall)	3	50	3	50	ns	17
t_{RCS}	Read command set-up time	0		0		ns	
t_{RCH}	Read command hold time	0		0		ns	
t_{WCH}	Write command hold time	55		75		ns	
t_{WCR}	Write command hold time referenced to $\overline{RAS}$	120		160		ns	
t_{WP}	Write command pulse width	55		75		ns	
t_{RWL}	Write command to row strobe lead time	70		85		ns	
t_{CWL}	Write command to column strobe lead time	70		85		ns	
t_{DS}	Data in set-up time	0		0		ns	18

SYM	PARAMETER	MKB4027-83		MKB4027-84		UNITS	NOTES
		MIN	MAX	MIN	MAX		
t_{DH}	Data in hold time	55		75		ns	18
t_{DHR}	Data in hold time referenced to $\overline{RAS}$	120		160		ns	
t_{CRP}	Column to row strobe precharge time	0		0		ns	
t_{CP}	Column precharge time	80		110		ns	
t_{RFSH}	Refresh Period		2		2	ms	
t_{WCS}	Write command set-up time	0		0			19
t_{CWD}	$\overline{CAS}$ to WRITE delay	80		80		ns	19
t_{RWD}	$\overline{RAS}$ to WRITE delay	145		175		ns	19
t_{DOH}	Data out hold time	5		5		μs	

NOTES (Continued)

7. All device pins at 0 volts except V_{BB} which is at -5 volts and the pin under test which is at -10 volts.
8. Output logic is disabled (high-impedance) and $\overline{RAS}$ and $\overline{CAS}$ are both at a logic 1. Transient stabilization is required prior to measurement of this parameter.
9. $0V \leq V_{OUT} \leq -10V$
10. Effective capacitance is calculated from the equation: $C = \frac{\Delta Q}{V}$ with $\Delta V = 3$ Volts
11. AC measurements assume $t_T = 5ns$.
12. The specification for t_{RC} (min) and t_{RWC} (min) are used only to indicate cycle time at which proper operation over the full temperature range ($-55°C \leq T_A \leq 85°C$) is assured. See Figure 2 for derating curve.
13. Assumes that $t_{RCD} \leq t_{RCD}$ (max)
14. Assumes that $t_{RCD} \geq t_{RCD}$ (max)
15. Measured with a load circuit equivalent to 2 TTL loads and 100pF.
16. Operation within the t_{RAC} (max) limit insures that t_{RCD} (max) is specified t_{RCD} (max) limit, then access time is controlled exclusively by t_{CAC}.
17. V_{IHC} (min) or V_{IH} (min) and V_{IL} (max) are reference levels for measuring timing of input signals. Also, transition times are measured between V_{IHC} or V_{IH} and V_{IL}.
18. These parameters are referenced to CAS leading edge in random write cycles to WRITE leading edge in delayed write or read-modify-write cycles.
19. t_{WCS}, t_{CWD}, and t_{RWD} are restrictive operating parameters in a read/write or read/modify/write cycle only. If $t_{WCS} \geq t_{WCS}$ (min), the cycle is an early write cycle and the Data Out will contain the data written into the selected cell. If $t_{CWD} \geq t_{CWD}$ (min) and $t_{RWD} \geq t_{RWD}$ (min), the cycle is a read-write cycle and Data Out will contain data read from the selected cell. If neither of the above sets of conditions is satisfied, the condition of Data Out (at access time) is indetermined.

AC ELECTRICAL CHARACTERISTICS

($-55°C \leq T_A \leq 85°C$)[1] ($V_{DD} = 12.0V \pm 10\%$, $V_{CC} = 5V \pm 10\%$, $V_{SS} = 0V$, $V_{BB} = -5.0V \pm 10\%$)

SYM	PARAMETER	TYP	MAX	UNITS	NOTES
C_{I1}	Input Capacitance (A_0 - A_5), D_{IN}, $\overline{CS}$	4	5	pF	10
C_{I2}	Input Capacitance $\overline{RAS}$, $\overline{CAS}$, $\overline{WRITE}$	8	10	pF	10
C_O	Output Capacitance (D_{OUT})	5	7	pF	8,10

SUPPLEMENTAL DATA SHEET TO BE USED IN CONJUNCTION WITH MOSTEK MK4027(J)-1/2/3 and MK4027(J)-4 DATA SHEETS