SUPPLEMENT

MOSTEK®

4096x1-BIT DYNAMIC RAM

MK4015 (J/N)

FEATURES

- ☐ Recognized industry standard 16-pin configuration from Mostek
- ☐ 250ns access time, 380ns cycle
- ☐ Output data latched and valid into next cycle
- ☐ Low Power: 462mW active (max)
  38mW standby (max)
- ☐ Improved performance with "gated $\overline{CAS}$", "$\overline{RAS}$ only" refresh, and Read-Modify-Write
- ☐ All inputs are low capacitance and TTL compatible
- ☐ Input latches for addresses, chip select and data in
- ☐ Three-state TTL compatible output

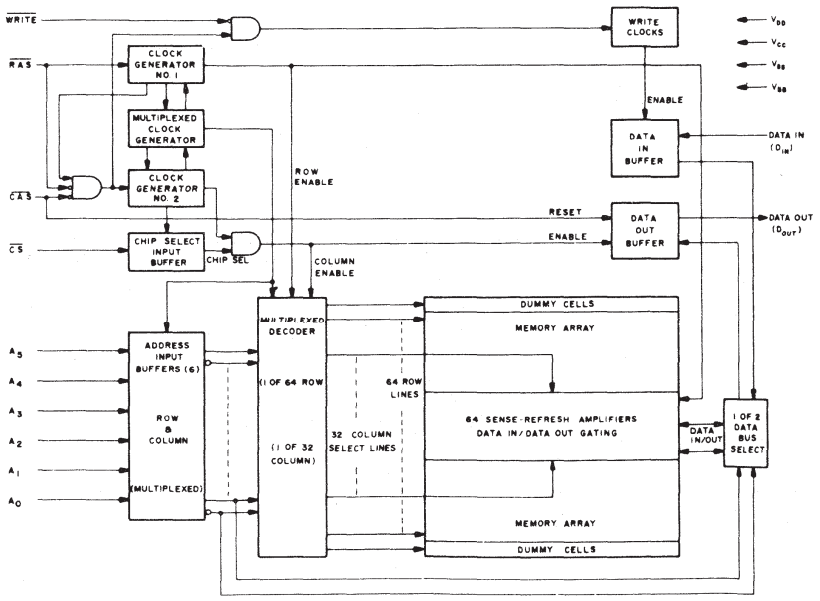
DESCRIPTION

The MK 4015 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 MK 4015 to be a high performance state-of-the-art memory circuit that is manufacturable in high volume. The MK 4015 employs a single transistor storage cell utilizing a dynamic storage technique and dynamic control circuitry to achieve optimum performance with low power dissipation.

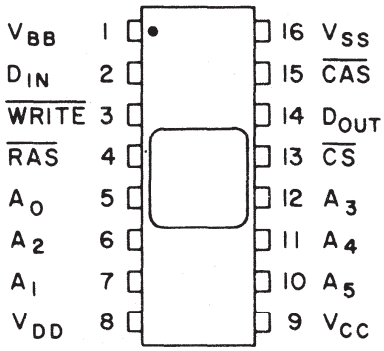
A unique multiplexing and latching technique for the address inputs permits the MK 4015 to be packaged in a standard 16-pin DIP on 0.3 in. centers. This package size provides high system-bit densities and is compatible with widely available automated testing and insertion equipment.

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, and two chip select methods to allow the user to determine the appropriate speed/power characteristics of his memory system. The MK 4015 also incorporates several flexible operating modes. In addition to the usual read and write cycles, read-modify write, and $\overline{RAS}$-only refresh cycles are available with the MK 4015.

FUNCTIONAL DIAGRAM



PIN CONNECTIONS



PIN NAMES

A_0-A_5	ADDRESS INPUTS
$\overline{CAS}$	COLUMN ADDRESS STROBE
$\overline{CS}$	CHIP SELECT
D_{IN}	DATA IN
D_{OUT}	DATA OUT
$\overline{RAS}$	ROW ADDRESS STROBE
$\overline{WRITE}$	READ/WRITE INPUT
V_{BB}	POWER (−5V)
V_{CC}	POWER (+5V)
V_{DD}	POWER (+ 12V)
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, T_A (Ambient) ..... 0°C to +55°C
Storage temperature (Ambient)(Ceramic) ..... −65°C to + 150°C
Storage temperature (Ambient)(Plastic) ..... −55°C to + 125°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]

($0°C \leqslant T_A \leqslant 55°C$) [1]

	PARAMETER	MIN	TYP	MAX	UNITS	NOTES
V_{DD}	Supply Voltage	11.4	12.0	12.6	volts	2
V_{CC}	Supply Voltage	4.5V	5.0	5.5	volts	2,3
V_{SS}	Supply Voltage	0	0	0	volts	2
V_{BB}	Supply Voltage	−4.5	−5.0	−5.5	volts	2
V_{IHC}	Logic 1 Voltage, $\overline{RAS}$, $\overline{CAS}$, $\overline{WRITE}$	3.0		7.0	volts	2
V_{IH}	Logic 1 Voltage, all inputs except $\overline{RAS}$, $\overline{CAS}$, $\overline{WRITE}$	3.0		7.0	volts	2
V_{IL}	Logic 0 Voltage, all inputs	−1.0		.65	volts	2

DC ELECTRICAL CHARACTERISTICS [4]

($0°C \leqslant T_A \leqslant 55°C$)[1] ($V_{DD}$ = 12.0V ± 5%; V_{CC} = 5.0V ± 10%; V_{SS} = 0V; V_{BB} = −5.0V ± 10%)

	PARAMETER	MIN	TYP	MAX	UNITS	NOTES
I_{DD1}	Average V_{DD} Power Supply Current			35	mA	5
I_{DD2}	Standby V_{DD} Power Supply Current			3	mA	8
I_{DD3}	Average V_{DD} Power Supply Current during "$\overline{RAS}$ only" cycles			25	mA	
I_{CC}	V_{CC} Power Supply Current				mA	6
I_{BB}	Average V_{BB} Power Supply Current			150	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			volts	
V_{OL}	Output Logic 0 Voltage @ I_{OUT} = 3.2mA			0.4	volts	

NOTES

1. T_A is specified for operation at frequencies to $t_{RC} \geqslant t_{RC}$ (min).
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.
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 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. $0V \leqslant V_{OUT} \leqslant +10V$.
10. Effective capacitance is calculated from the equation:

    $C = \frac{\Delta Q}{\Delta V}$ with ΔV = 3 volts.

11. A.C. measurements assume t_T = 5ns.

ELECTRICAL CHARACTERISTICS AND RECOMMENDED AC OPERATING CONDITIONS[4,11,17]

(0°C ≤ TA ≤ 55°C)[1] (VDD = 12.0V ± 5%, VCC = 5.0V ± 10%, VSS = OV, VBB = -5.0V ± 10%)

	PARAMETER	MK4015 MIN	MK4015 MAX	Units	Notes
t_{RC}	Random read or write cycle time	380		ns	
t_{RWC}	Read write cycle time	395		ns	
t_{RMW}	Read modify write cycle time	470		ns	
t_{RAC}	Access time from row address strobe		250	ns	13,15
t_{CAC}	Access time from column address strobe		165	ns	14,15
t_{OFF}	Output buffer turn-off delay		60	ns	
t_{RP}	Row address strobe precharge time	120		ns	
t_{RAS}	Row address strobe pulse width	250	4000	ns	
t_{RSH}	Row address strobe hold time	165		ns	
t_{CAS}	Column address strobe pulse width	165	4000	ns	
t_{CSH}	Column address strobe hold time	250		ns	
t_{RCD}	Row to column strobe delay	35	85	ns	16
t_{ASR}	Row address set-up time	0		ns	
t_{RAH}	Row address hold time	35		ns	
t_{ASC}	Column address set-up time	0		ns	
t_{CAH}	Column address hold time	75		ns	
t_{AR}	Column address hold time referenced to RAS	160		ns	
t_{CSC}	Chip select set-up time	0		ns	
t_{CH}	Chip select hold time	75		ns	
t_{CHR}	Chip select hold time referenced to RAS	160		ns	
t_{T}	Transition time (rise and fall)	3	50	ns	17
t_{RCS}	Read command set-up time	0		ns	
t_{RCH}	Read command hold time	0		ns	
t_{WCH}	Write command hold time	75		ns	
t_{WCR}	Write command hold time referenced to RAS	160		ns	
t_{WP}	Write command pulse width	75		ns	
t_{RWL}	Write command to row strobe lead time	100		ns	
t_{CWL}	Write command to column strobe lead time	100		ns	
t_{DS}	Data in set-up time	0		ns	18
t_{DH}	Data in hold time	75		ns	18
t_{DHR}	Data in hold time referenced to RAS	160		ns	
t_{CRP}	Column to row strobe precharge time	0		ns	
t_{RFSH}	Refresh period		1	ms	
t_{WCS}	Write command set-up time	0		ns	19
t_{CWD}	CAS to WRITE delay	90		ns	19
t_{RWD}	RAS to WRITE delay	175		ns	19
t_{DOH}	Data out hold time	4		μs	

Notes Continued

13. Assumes that $t_{RCD} \leqslant t_{RCD}$ (max).
14. Assumes that $t_{RCD} \geqslant t_{RCD}$ (max).
15. Measured with a load circuit equivalent to 2 TTL loads and 100pF
16. Operation within the t_{RCD} (max) limit insures that t_{RAC} (max) can be met. t_{RCD} (max) is specified as a reference point only; if t_{RCD} is greater than the 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 $\overline{CAS}$ leading edge in random write cycles and to $\overline{WRITE}$ 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 $t_{WCS} \geqslant t_{WCS}$ (min), the cycle is an early write cycle and Data Out will contain the data written into the selected cell. If $t_{CWD} \geqslant t_{CWD}$ (min) and $t_{RWD} \geqslant t_{RWD}$ (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 indeterminate.

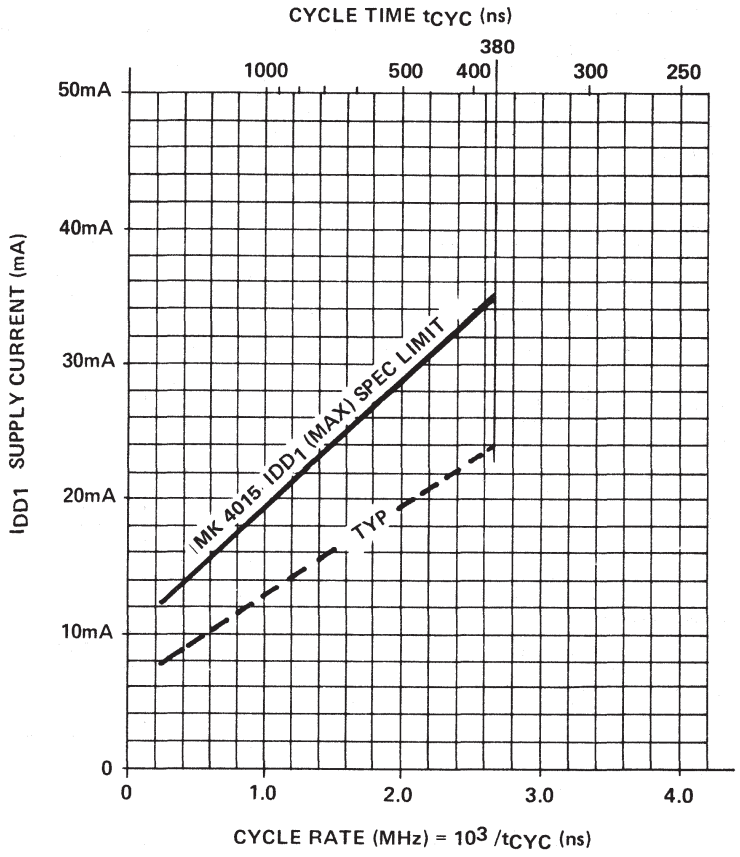
AC ELECTRICAL CHARACTERISTICS

(0°C ≤ T_A ≤ 55° C) (V_{DD} = 12V ± 5%; V_{SS} = 0V; V_{BB} = –5.0V ± 10%)

	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

MAXIMUM I_{DD1} vs. CYCLE RATE

Figure 1



SUPPLEMENT - To be used in conjunction with MK4027(P/J/N)-1/2/3 data sheet.