16Mx36 DRAM SIMM

FEATURES

- Performance range:

	t_{RAC}	t_{CAC}	t_{RC}
WPD16M36-60MSC	60ns	15ns	110ns
WPD16M36-70MSC	70ns	20ns	130ns
WPD16M36-80MSC	80ns	20ns	150ns

- Fast Page Mode operation
- $\overline{CAS}$-before-$\overline{RAS}$ refresh capability
- $\overline{RAS}$-only and Hidden refresh capability
- TTL compatible inputs and outputs
- Single +5V ± 10% power supply
- 4096 cycles/64ms refresh
- JEDEC standard pinout

GENERAL DESCRIPTION

The WPD16M36-XMSC is a 16Mbit x 36 Dynamic RAM high density memory module. The WPD16M36-XMSC consists of 36 CMOS 16M x 1 bit DRAMs in 24-pin TSOP packages. The DRAMs are mounted in eight stacks of four chips on the front, and four single chips for parity on the back of a 72-pin glass epoxy substrate. A 0.1µF decoupling capacitor is mounted for each stack of the eight DRAM on the front of the module, and for each DRAM on the back of the module. The $\overline{RAS}$, $\overline{CAS}$, $\overline{W}$, and address signal are buffered.

The WPD16M36-XMSC is a Single In-line Memory Module with tin or gold edge connections and is intended for mounting into 72-pin edge connector sockets.

Pin Names

Pin Name	Pin Function
A_0-A_{11}	Address Inputs
DQ_0-DQ_{35}	Data In/Out
$\overline{W}$	Read/Write Input
$\overline{RAS_0}$, $\overline{RAS_2}$	Row Address Strobe
$\overline{CAS_0}$-$\overline{CAS_3}$	Column Address Strobe
PD_1-PD_5	Presence Detect
V_{CC}	Power (+5V)
V_{SS}	Ground
NC	No Connection

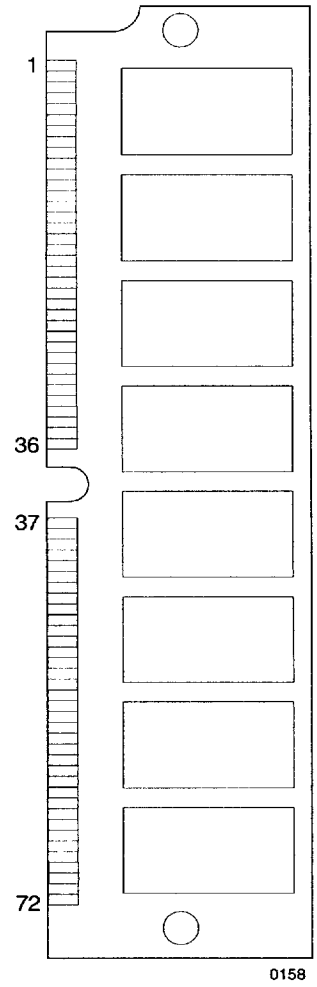
Presence Detect Pins*
(Optional)

Pin	60ns	70ns	80ns
PD_1	V_{SS}	V_{SS}	V_{SS}
PD_2	V_{SS}	V_{SS}	V_{SS}
PD_3	NC	V_{SS}	NC
PD_4	NC	NC	V_{SS}
PD_5	NC	NC	NC

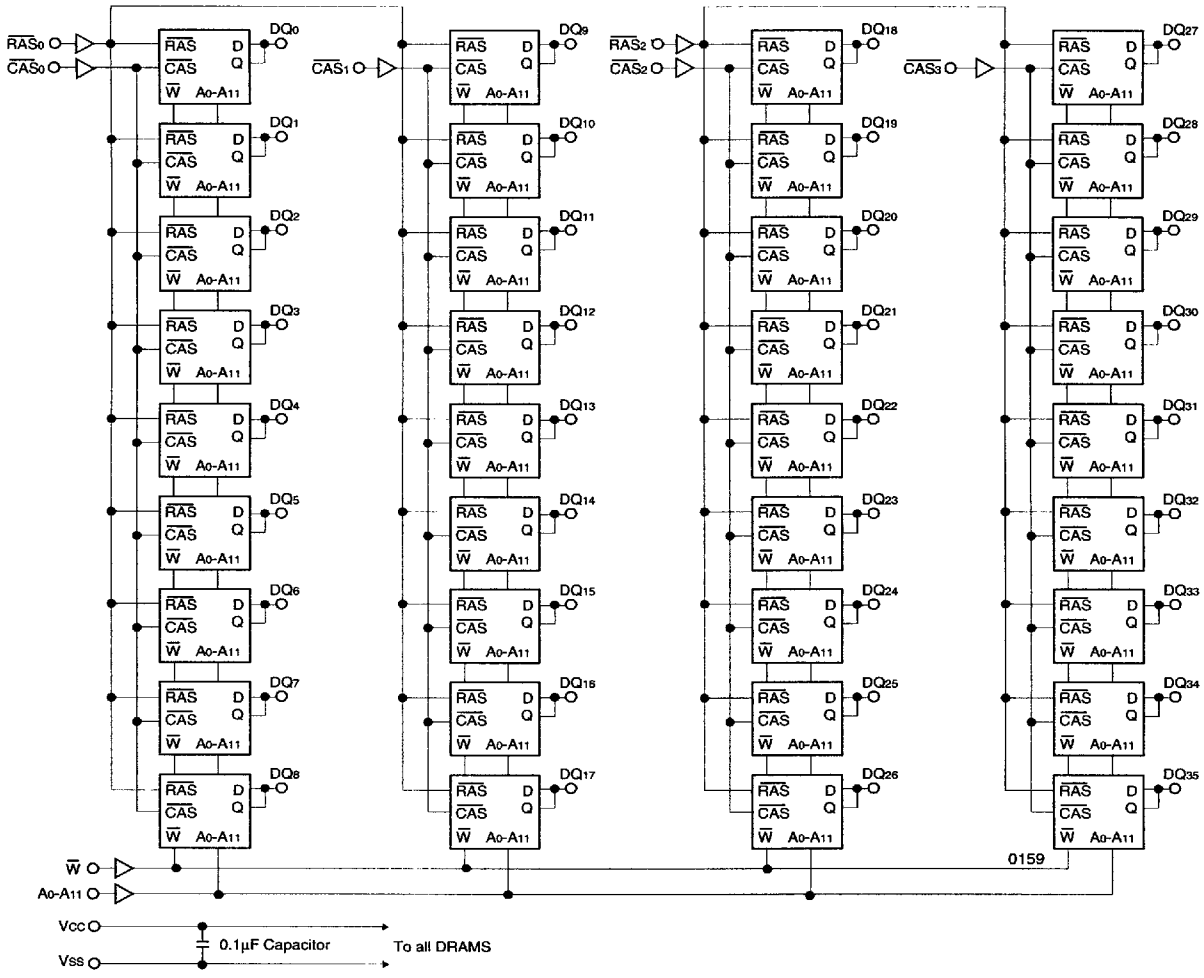
* Pin Connection Changing Available

PIN CONFIGURATION (Front View)

Pin	Symbol	Pin	Symbol	Pin	Symbol
1	V_{SS}	25	DQ_{24}	49	DQ_{9}
2	DQ_{0}	26	DQ_{7}	50	DQ_{27}
3	DQ_{18}	27	DQ_{25}	51	DQ_{10}
4	DQ_{1}	28	A_{7}	52	DQ_{28}
5	DQ_{19}	29	A_{11}	53	DQ_{11}
6	DQ_{2}	30	V_{CC}	54	DQ_{29}
7	DQ_{20}	31	A_{8}	55	DQ_{12}
8	DQ_{3}	32	A_{9}	56	DQ_{30}
9	DQ_{21}	33	NC	57	DQ_{13}
10	V_{CC}	34	$\overline{RAS}_{2}$	58	DQ_{31}
11	PD_{5}	35	DQ_{26}	59	V_{CC}
12	A_{0}	36	DQ_{8}	60	DQ_{32}
13	A_{1}	37	DQ_{17}	61	DQ_{14}
14	A_{2}	38	DQ_{35}	62	DQ_{33}
15	A_{3}	39	V_{SS}	63	DQ_{15}
16	A_{4}	40	$\overline{CAS}_{0}$	64	DQ_{34}
17	A_{5}	41	$\overline{CAS}_{2}$	65	DQ_{16}
18	A_{6}	42	$\overline{CAS}_{3}$	66	NC
19	A_{10}	43	$\overline{CAS}_{1}$	67	PD_{1}
20	DQ_{4}	44	$\overline{RAS}_{0}$	68	PD_{2}
21	DQ_{22}	45	NC	69	PD_{3}
22	DQ_{5}	46	NC	70	PD_{4}
23	DQ_{23}	47	$\overline{W}$	71	NC
24	DQ_{6}	48	NC	72	V_{SS}



FUNCTIONAL BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS*

Item	Symbol	Rating	Units
Voltage on Any Pin Relative to V_{SS}	V_{IN}, V_{OUT}	-1 to +7.0	V
Voltage on V_{CC} Supply Relative to V_{SS}	V_{CC}	-1 to +7.0	V
Storage Temperature	T_{stg}	-55 to +150	°C
Power Dissipation	P_D	21.6	W
Short Circuit Output Current	I_{OS}	50	mA

* Permanent device damage may occur if "ABSOLUTE MAXIMUM RATINGS" are exceeded. Functional Operation should be restricted to the conditions as detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

RECOMMENDED OPERATING CONDITIONS (Voltage reference to V_{SS}, T_A=0 to 70°C)

Item	Symbol	Min	Typ	Max	Unit
Supply Voltage	V_{CC}	4.5	5.0	5.5	V
Ground	V_{SS}	0	0	0	V
Input High Voltage	V_{IH}	2.4	—	V_{CC}+1	V
Input Low Voltage	V_{IL}	-1.0	—	0.8	V

DC AND OPERATION CHARACTERISTICS

(Recommended operating conditions unless otherwise noted.)

Parameter		Symbol	Min	Max	Units
Operating Current* ($\overline{RAS}$, $\overline{CAS}$, Address Cycling @t_{RC}=min.)	WPD16M36-60	I_{CC1}	—	3240	mA
	WPD16M36-70		—	2880	mA
	WPD16M36-80		—	2520	mA
Standby Current ($\overline{RAS}$=$\overline{CAS}$=V_{IH})		I_{CC2}	—	72	mA
$\overline{RAS}$-Only Refresh Current* ($\overline{CAS}$=V_{IH}, $\overline{RAS}$, Address Cycling @t_{RC}=min.)	WPD16M36-60	I_{CC3}	—	3240	mA
	WPD16M36-70		—	2880	mA
	WPD16M36-80		—	2520	mA
Fast Page Mode Current* ($\overline{RAS}$=V_{IL}, $\overline{CAS}$, Address Cycling: t_{PC}=min.)	WPD16M36-60	I_{CC4}	—	2880	mA
	WPD16M36-70		—	2520	mA
	WPD16M36-80		—	2160	mA
Standby Current ($\overline{RAS}$=$\overline{CAS}$=V_{CC}-0.2V)		I_{CC5}	—	36	mA
$\overline{CAS}$-Before-$\overline{RAS}$ Refresh Current* ($\overline{RAS}$ and $\overline{CAS}$ Cycling @t_{RC}=min.)	WPD16M36-60	I_{CC6}	—	3240	mA
	WPD16M36-70		—	2880	mA
	WPD16M36-80		—	2520	mA
Input Leakage Current (Any input 0≤V_{IN}≤6.5V, all other pins not under test=0V)		I_{IL}	-360	360	µA
Output Leakage Current (Data out is disabled, 0≤V_{OUT}≤5.5V)		I_{OL}	-10	10	µA
Output High Voltage Level (I_{OH}=-5mA)		V_{OH}	2.4	—	V
Output Low Voltage Level (I_{OL}=4.2mA)		V_{OL}	—	0.4	V

*NOTE: I_{CC1}, I_{CC3}, I_{CC4}, and I_{CC6} are dependent on output loading and cycling rates. Specified values are obtained with the output open. I_{CC} is specified as an average current.

CAPACITANCE (T_A=25 °C)

Item	Symbol	Min	Max	Unit
Input Capacitance (A_0-A_{11})	C_{IN1}	—	10	pF
Input Capacitance ($\overline{W}$)	C_{IN2}	—	10	pF
Input Capacitance ($\overline{RAS}_0$, $\overline{RAS}_2$)	C_{IN3}	—	10	pF
Input Capacitance ($\overline{CAS}_0$-$\overline{CAS}_3$)	C_{IN4}	—	10	pF
Input/Output Capacitance (DQ_{0-35})	C_{DQ}	—	12	pF

AC CHARACTERISTICS (T_A=0 °C to 70 °C, V_{CC}=5.0V±10%, See notes 1, 2)

Parameter	Symbol	WPD16M36-60		WPD16M36-70		WPD16M36-80		Unit
		Min	Max	Min	Max	Min	Max	
Random read or write cycle time	t_{RC}	110		130		150		ns
Access time from $\overline{RAS}$ (3, 4)	t_{RAC}		60		70		80	ns
Access time from $\overline{CAS}$ (3, 4, 5)	t_{CAC}		15		20		20	ns
Access time from column address (3, 11)	t_{AA}		30		35		40	ns
$\overline{CAS}$ to output in Low-Z (3)	t_{CLZ}	0		0		0		ns
Output buffer turn-off delay (7)	t_{OFF}	0	15	0	20	0	20	ns
Transition time (rise and fall) (2)	t_T	3	50	3	50	3	50	ns
$\overline{RAS}$ precharge time	t_{RP}	40		50		60		ns
$\overline{RAS}$ pulse width	t_{RAS}	60	10,000	70	10,000	80	10,000	ns
$\overline{RAS}$ hold time	t_{RSH}	15		20		20		ns
$\overline{CAS}$ hold time	t_{CSH}	60		70		80		ns
$\overline{CAS}$ pulse width	t_{CAS}	15	10,000	20	10,000	20	10,000	ns
$\overline{RAS}$ to $\overline{CAS}$ delay time (4)	t_{RCD}	20	45	20	50	20	60	ns
$\overline{RAS}$ to column address delay time (11)	t_{RAD}	15	30	15	35	15	40	ns
$\overline{CAS}$ to $\overline{RAS}$ precharge time	t_{CRP}	5		5		5		ns
Row address set-up time	t_{ASR}	0		0		0		ns
Row address hold time	t_{RAH}	10		10		10		ns
Column address set-up time	t_{ASC}	0		0		0		ns
Column address hold time	t_{CAH}	10		15		15		ns
Column address hold referenced to $\overline{RAS}$ (6)	t_{AR}	45		55		60		ns
Column address to $\overline{RAS}$ lead time	t_{RAL}	30		35		40		ns
Read command set-up time	t_{RCS}	0		0		0		ns
Read command hold referenced to $\overline{CAS}$ (9)	t_{RCH}	0		0		0		ns
Read command hold referenced to $\overline{RAS}$ (9)	t_{RRH}	0		0		0		ns
Write command hold time	t_{WCH}	10		15		15		ns
Write command hold referenced to $\overline{RAS}$ (6)	t_{WCR}	45		55		60		ns
Write command pulse width	t_{WP}	10		15		15		ns
Write command to $\overline{RAS}$ lead time	t_{RWL}	15		20		20		ns
Write command to $\overline{CAS}$ lead time	t_{CWL}	15		20		20		ns

continued on the next page

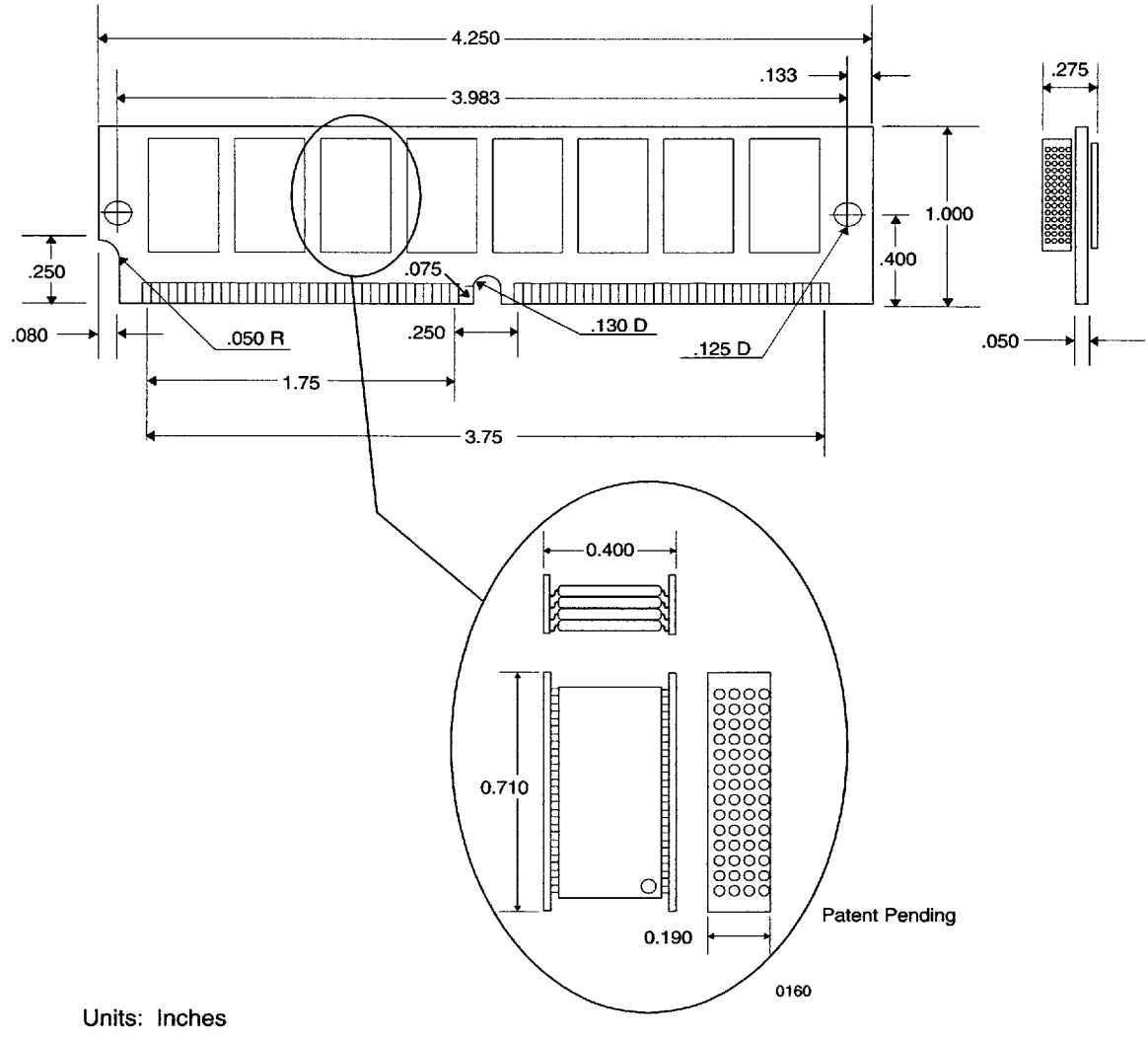
AC CHARACTERISTICS (continued)

Parameter	Symbol	WPD16M36-60		WPD16M36-70		WPD16M36-80		Unit
		Min	Max	Min	Max	Min	Max	
Data-in set-up time (10)	t_{DS}	0		0		0		ns
Data-in hold time (10)	t_{DH}	10		15		15		ns
Data-in hold referenced to $\overline{RAS}$ (6)	t_{DHR}	45		55		60		ns
Refresh period	t_{REF}		64		64		64	ms
Write command set-up time (8)	t_{WCS}	0		0		0		ns
$\overline{CAS}$ set-up time ($\overline{C}$-B-$\overline{R}$ refresh)	t_{CSR}	5		5		5		ns
$\overline{CAS}$ hold time ($\overline{C}$-B-$\overline{R}$ refresh)	t_{CHR}	10		15		15		ns
$\overline{RAS}$ precharge to $\overline{CAS}$ hold time	t_{RPC}	5		5		5		ns
Access time from $\overline{CAS}$ precharge (3)	t_{CPA}		35		40		45	ns
Fast Page mode cycle time	t_{PC}	40		45		50		ns
$\overline{CAS}$ precharge time (fast page)	t_{CP}	10		10		10		ns
$\overline{RAS}$ pulse width (fast page)	t_{RASP}	60	200,000	70	200,000	80	200,000	ns
$\overline{W}$ to $\overline{RAS}$ precharge time	t_{WRP}	10		10		10		ns
($\overline{C}$-B-$\overline{R}$ refresh)								
$\overline{W}$ to $\overline{RAS}$ hold time ($\overline{C}$-B-$\overline{R}$ refresh)	t_{WRH}	10		10		10		ns
$\overline{CAS}$ precharge ($\overline{C}$-B-$\overline{R}$ counter test)	t_{CPT}	20		30		30		ns

NOTES

1. An initial pause of 200 µs is required after power-up followed by any 8 $\overline{RAS}$ cycles before proper device operation is achieved.
2. $V_{IH(min)}$ and $V_{IL(max)}$ are reference levels for measuring timing of input signals. Transition times are measured between $V_{IH(min)}$ and $V_{IL(max)}$, and are assumed to be 5ns for all inputs.
3. Measure with a load equivalent to 2 TTL loads and 100pF.
4. 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}.
5. Assumes that $t_{RCD} \geq t_{RCD(max)}$.
6. t_{AR}, t_{WCR}, t_{DHR} are referenced to $t_{RAD(max)}$.
7. This parameter defines the time at which the output achieves the open circuit condition and is not referenced to V_{OH} or V_{OL}.
8. t_{WCS}, t_{RWD}, t_{CWD}, and t_{AWD} are non-restrictive operating parameters. They are included in the data sheet as electrical characteristics only. If $t_{WCS} \geq t_{WCS(min)}$ the cycle is an early write cycle and the data out pin will remain high impedance for the duration of the cycle.
9. Either t_{RCH} or t_{RRH} must be satisfied for a read cycle.
10. These parameters are referenced to the $\overline{CAS}$ leading edge in early write cycles and to the $\overline{W}$ leading edge in read-write cycles.
11. Operation within the $t_{RAD(max)}$ limit insures that $t_{RAC(max)}$ can be met. $t_{RAD(max)}$ is specified as a reference point only. If t_{RAD} is greater than the specified $t_{RAD(max)}$ limit, then access time is controlled by t_{AA}.

PACKAGE DIMENSIONS



TOLERANCES: ±0.005 UNLESS OTHERWISE SPECIFIED

ORDERING INFORMATION