



TM

Burst EDO DRAMs

MICRON
TECHNOLOGY, INC.

What are Burst EDO DRAMs?

Burst EDO (BEDO) DRAMs are the Best Solution for 66 MHz Systems

- ❑ Standard DRAMs with shorter page mode cycle times
- ❑ EDO DRAMs that contain a pipeline stage and a 2-bit burst counter
- ❑ Bond option on standard DRAMs
- ❑ Same package, pinout and die as Fast Page Mode (FPM) and Extended Data-Out (EDO) DRAMs
- ❑ Support existing SIMM and DIMM standards
- ❑ Offered in x4, x8, and x16 configurations
- ❑ Processor-compatible four-cycle burst access
- ❑ Zero-wait-state operation at 66 MHz
- ❑ Available now

Burst EDO vs. Synchronous DRAM

BEDO is Technologically Superior

66 MHz Design	BEDO	SDRAM*
Latency from CAS	2 clocks	3 clocks
Access time from CAS/clock	10ns	10ns
Read data hold time	3ns	3ns
Lead-off cycle (page open)	2 clocks	3 clocks
Lead-off cycle (page closed)	7 clocks	7 clocks

*Combination specification from several synchronous DRAM specs for multi-source solutions.

BEDO is Economically Superior

	FPM	BEDO	SDRAM
Relative die size	1.00	1.00	1.03 - 1.10
Implementation	B/F* option	B/F* option	Separate die
Relative manufacturing cost			
Die cost	1.00	1.00	1.03 - 1.12
Assembly cost	1.00	1.00	1.05
Test cost	1.00	1.00	1.05 - 1.50
Total relative cost	1.00	1.00	1.13 - 1.67

*B/F = bond or fuse option

Frequently Asked Questions

❑ Are There Multiple Sources?

- Seven DRAM manufacturers have publicly announced production support

Hyundai

Oki

Siemens

Micron

Samsung

Toshiba

Mitsubishi

Kingston Technology, PNY Electronics and most of the above DRAM suppliers will offer BEDO DRAM modules as well.

- Other suppliers have been known to say:

“Some of our engineers believe it will always be difficult to get the cost down on the pipelined SDRAMs because the die size is larger....the burst EDO approach is a simple solution....that is why we have two competing engineering groups....”

EE Times, 8/7/1995

Frequently Asked Questions (Continued)

❑ What About Chipset Support?

- Ten chipset suppliers have announced support

ACC Micro

Acer Laboratories (ALi)

OPTi

PC Tech

Pico Power Technology (Cirrus Logic)

SiS

UMC

Vadem

VIA Technologies

Winbond & Symphony

- VIA Technologies, Pico Power and UMC have silicon NOW - ask for a demonstration.

Frequently Asked Questions (Continued)

❑ What About OEM Support?

- Nine OEM supporters have announced support (several others are in design)

Acer

Dell Computer

DFI

First International Computer

Gateway 2000

Matsushita Electric (Panasonic)

Micronics Computers (motherboards)

Micron Electronics (Micron, Zeos)

Tatung

- More OEMs are joining daily due to backward compatibility with FPM/EDO components, SIMMs and DIMMs
- Mixture of SIMMs/DIMMs (FPM/EDO/BEDO) allowed at system level

❑ Why Use a 66 MHz BEDO When SDRAM Can Go 100 MHz?

- Both DRAM types require 52ns ^tRAC
- Both have access times of 10ns
- BEDO has latency of 2; SDRAM has latency of 3
- 100-MHz-specified SDRAMs are required for zero wait-state operation at 66 MHz

Frequently Asked Questions (Continued)

❑ Is BEDO Only a Short-Term Solution?

- The main-volume PC data bus will be 66 MHz for the life of the Pentium.™

Pentium	
Processor Internal Clock Speed (MHz)	External DRAM Bus Speed (MHz)
90	60
100	66
120	60
133	66
150	60
166	66

- BEDO performance is not limited to 66 MHz; a 75 MHz data sheet is being finalized.
- The P6 also uses a 66 MHz memory bus.

DRAM Selector Guide

MEMORY CONFIG.	FEATURES (OPTIONS)	PART NUMBER	ACCESS TIME	PACKAGE/#OF PINS			SAMP. AVAIL.	PROD. AVAIL.
				TQFP	SOJ	TSOP		
DRAMs								
4 Meg x 1	FPM	MT4C1004J	60	-	20/26	20/26	Now	Now
1 Meg x 4	FPM	MT4C4001J	60	-	20/26	20/26	Now	Now
1 Meg x 4	EDO	MT4C4007J	60	-	20/26	-	Now	Now
4 Meg x 4	FPM, 2K refresh, 3.3V ¹	MT4LC4M4B1(L)	60,70	-	24/26	-	Now	Now
4 Meg x 4	EDO, 2K refresh, 3.3V ¹	MT4LC4M4E8(L)	60,70	-	24/26	-	Now	Now
4 Meg x 4	BEDO, 2K refresh, 3.3V ¹	MT4LC4M4G6	52,60,70	-	24/26	-	Now	Now
2 Meg x 8	FPM, 2K refresh, 300 mil, 3.3V ¹	MT4LC2M8B1(L)	60,70	-	28	28	Now	Now
2 Meg x 8	EDO, 2K refresh, 300 mil, 3.3V ¹	MT4LC2M8E7(L)	60,70	-	28	28	Now	Now
2 Meg x 8	BEDO, 2K refresh, 3.3V ¹	MT4LC2M8F4	52,60,70	-	28	-	Now	Now
256K x 16	FPM	MT4C16257	60,70	-	40	-	Now	Now
256K x 16	FPM (low power)	MT4C16257(L)	60,70	-	40	-	Now	Now
256K x 16	EDO	MT4C16270	50 ² ,60,70	-	40	-	Now	Now
1 Meg x 16	FPM, 1K refresh, 3.3V ¹	MT4LC1M16C3	60,70	-	-	44/50	Now	Now
1 Meg x 16	EDO, 1K refresh, 3.3V ¹	MT4LC1M16E5	60,70	-	-	44/50	Now	Now
1 Meg x 16	BEDO, 1K refresh, 3.3V ¹	MT4LC1M16H5	52,60,70	-	42	44/50	Now	Now

SYNCHRONOUS GRAPHICS RAM (SGRAM)

256K x 32	Pulsed $\overline{\text{RAS}}$, dual bank, pipelined, 3.3V	MT41LC256K32D4	12,15,17	100	-	-	1Q96	2Q96
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MEMORY CONFIG.	FEATURES (OPTIONS)	PART NUMBER	ACCESS TIME	PACKAGE TYPE / NUMBER OF PINS		SAMP. AVAIL.	PROD. AVAIL.
				SIMM	DIMM		

DRAM MODULES

256K x 32		MT2D25632	60,70	72	-	Now	Now
512K x 32		MT4D51232	60,70	72	-	Now	Now
1 Meg x 32	(EDO)	MT8D132(X)	60,70	72	-	Now	Now
1 Meg x 32	(EDO), (BEDO)	MT2D(T)132(X)(B)	52 ³ ,60,70	72	-	Now	Now
1 Meg x 32	(EDO), (BEDO), 3.3V, small-outline	MT2LDT132H(L)(X)(B)	52 ³ ,60,70	-	72	Now	Now
2 Meg x 32	(EDO), (BEDO), 3.3V, small-outline	MT4LDT232H(L)(X)(B)	52 ³ ,60,70	-	72	Now	Now
2 Meg x 32	(EDO), (BEDO)	MT4D232(X)(B)	52 ³ ,60,70	72	-	Now	Now
2 Meg x 32	(EDO)	MT16D232(X)	60,70	72	-	Now	Now
4 Meg x 32	(EDO), (BEDO)	MT8D432(X)(B)	52 ³ ,60,70	72	-	Now	Now
4 Meg x 32	(EDO), (BEDO), 3.3V, small-outline	MT8LDT432H(L)(X)(B)	52 ³ ,60,70	-	72	TBD	TBD
8 Meg x 32	(EDO)	MT16D832(X)	60,70	72	-	Now	Now
4 Meg x 36		MT12D436	60,70	72	-	Now	Now
8 Meg x 36		MT24D836	60,70	72	-	Now	Now
1 Meg x 64	(EDO)	MT16D164(X)	60,70	-	168	Now	Now
1 Meg x 64	(EDO), (BEDO), 3.3V, (nonbuffered)	MT4LD(T)164(X)(B)(N)	52 ³ ,60,70	-	168	Now	Now
2 Meg x 64	(EDO), (BEDO), 3.3V, (nonbuffered)	MT8LDT264(X)(B)(N)	52 ³ ,60,70	-	168	Now	1Q96
4 Meg x 64	(EDO), (BEDO), 3.3V, (nonbuffered)	MT16LDT464(X)(B)(N)	52 ³ ,60,70	-	168	TBD	TBD
2 Meg x 72	ECC, (EDO), (BEDO), 3.3V, (nonbuffered)	MT9LDT272(X)(B)(N)	52 ³ ,60,70	-	168	Now	Now
4 Meg x 72	ECC, (EDO), (BEDO), 3.3V, (nonbuffered)	MT18LDT472(X)(B)(N)	52 ³ ,60,70	-	168	Now	Now

¹5V-tolerant input and I/Os, ²Late 1995 production availability for 50ns parts, ³Burst EDO versions only

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