

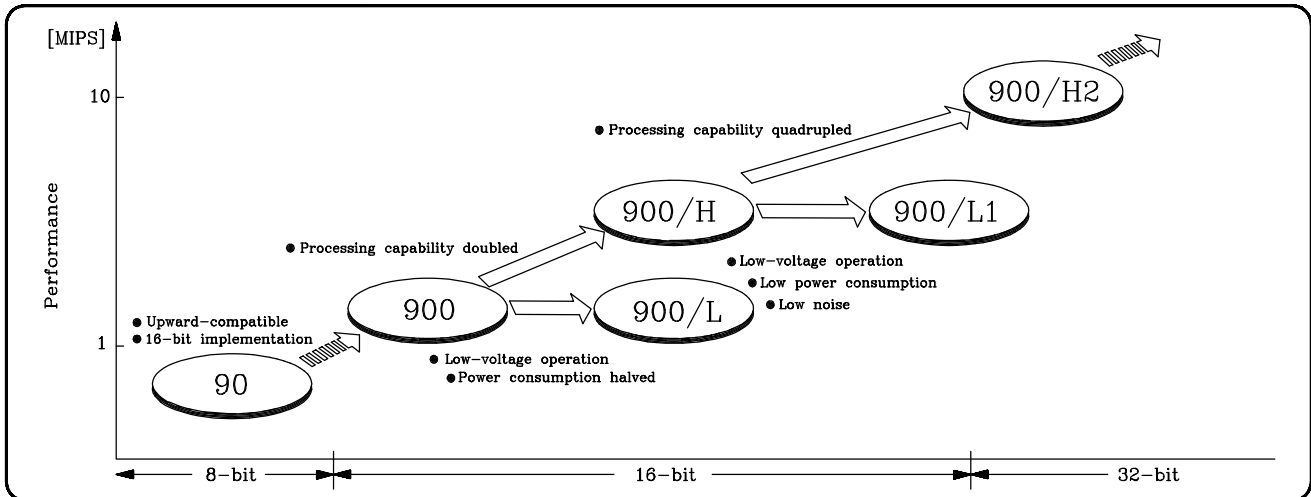
16-bit Microcontrollers

KLCS-900 Series

16/32-bit microcontrollers developed for C language code efficiency

The **900 Series** is comprised of highly functional microcontrollers combining the best of Toshiba technologies. The microcontrollers in this family are available as the processor core for a wide variety of applications, including office equipment, such as printers and facsimiles, complex electronic household appliance, such as VCRs and video cameras and cellular phones and other information-based equipment.

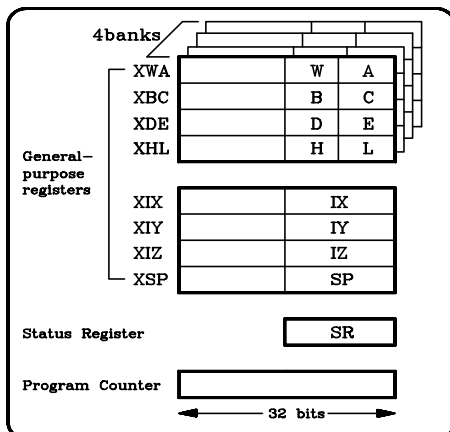
Core expansion keeping pace with applications



Core expansion keeping pace with applications

	900/H2 Series	900/H, 900/L1 Series	900, 900/L Series
Maximum operating frequency (@input frequency)	20MHz (@10 MHz)	12.5MHz (@25 MHz)	10MHz (@20 MHz)
Minimum instruction execution time	50 ns	160 ns	200 ns
Address space	16 Mbytes of linear address space(for program and data)		
Data transfer rate (Micro DMA)	0.25 μ s	0.64 μ s	1.6 μ s
Instructions for processing 32-bit data	Transfer, arithmetic/ logic operations and shift instructions		
Bit-processing instructions	Transfer, logic operations, Test, Set, Reset, Search		
Multiply instruction execution time (16-bit operands, 32-bit result)	600 ns	960 ns	2.6 μ s
Dynamic bus sizing	8-/16-/32-bit	8-/16-bit	

Register model



- **32-bit wide general-purpose registers**
Can be used for address calculations.
Code size reduction is possible.
- **Abundant general-purpose registers**
Flexible code generation by compiler.
Code size reduction is possible
- **Register bank method**
Ideal for real-time processing

Main applications

Office equipment

- Printers
- FAX machines

Office equipment

- DVD players
- Digital video cameras

Office equipment

- PICS
- Cellular phones
- PCS

16-bit Microcontrollers

■ KLCS-900/L Series

Low power consumption design ideal for high-performance portable equipment

■ Features

- **Successive KLCS-900 architecture**
 - : Instruction compatible with KLCS-900 series
 - : General purpose 32-bit register
 - : Register bank format
- **Operative on a low power consumption**
 - : Clock gear function/Dual clock function
 - : Four standby modes
 - : Power consumption : 7mA(3V, 12.5MHz, typ.)
- **Operative on a low voltage 4.5V+0.55V @20MHz**
 - : Power supply voltage : 2.7V to 5.5V @12.5MHz
- **Minimum instruction execution time**
 - : 200nS (at 20MHz)
- **Linear address space**
 - : Program : 64k byte/16M bytes
 - : Data : 16M bytes

■ Additional functions

- Built-in ROM
- 10-bit A/D converter
- Interrupt controllers
 - : 6 external interrupts, 14 internal interrupts
 - : 7-level priority can be set
- General purpose serial interface : 2channels
 - : Usable with a synchronous/an asynchronous transmission for both channels

■ Application

- Digital movie cameras
- Portable MD players
- Cellular phones

■ KLCS-900/L1 Series

Next-generation 16-bit microprocessors offering both high performance and low-power operation

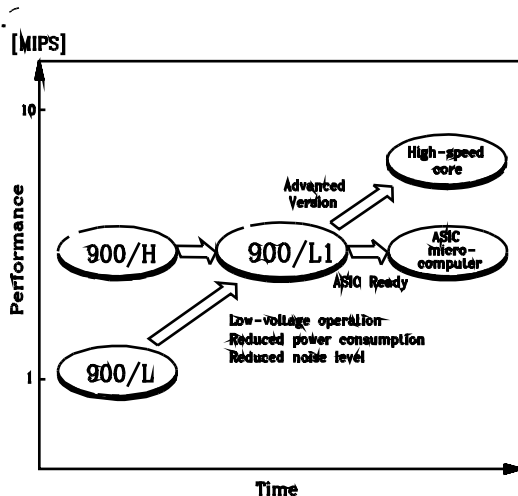
■ Features

- **Low-voltage operation: 1.8V to 5.5V**
- **Low-power consumption:**
 - 3.0mA (when operating at 3V and 16MHz)
- **Low-noise (EMC register)**
 - EMI: reduced by 30%
 - EMS: noise filter, protection register

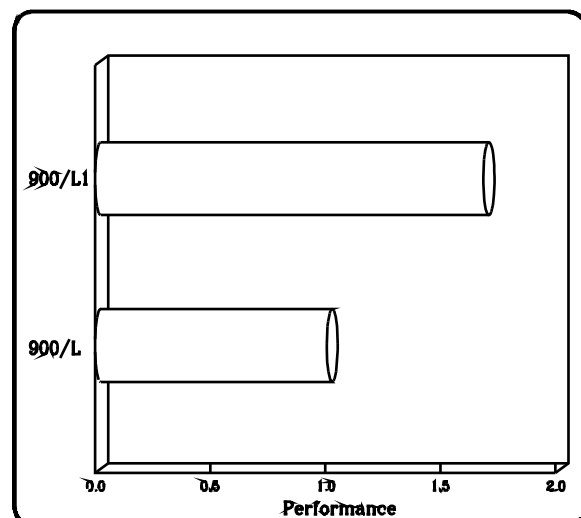
■ Application

- DSCS
- DVCs
- Portable communication

■ Core expansion



■ Comparison of core performance(with 900/L)



16-bit Microcontrollers

KLCS-900/H Series

High-performance devices ideally suited to high-end office equipment

Features

- **Successive KLCS-900 architecture**
 - : Instruction compatible with KLCS-900, 900/L series
 - : General purpose 32-bit register
 - : Register bank format
- **Increased instruction execution speed**
 - : 2 times the speed of KLCS-900, 900/L series
- **Simple bus interface**
 - : Separate bus
 - : Access time : 100nS (at 25MHz, 0 wait)
- **Minimum instruction execution time**
 - : 160nS (at 25MHz)
- **Large linear address**
 - : Program : 16M bytes
 - : Data : 16M bytes

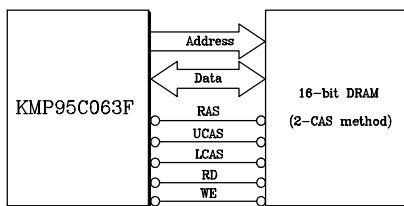
Additional functions

- DRAM controller (direct interface enabled)
- High-speed macro DMA
- 10-bit A/D converter
- Interrupt controller
- General purpose serial interface
- Since memory is refreshed asynchronously with cpu operation, access to other resources is not degraded

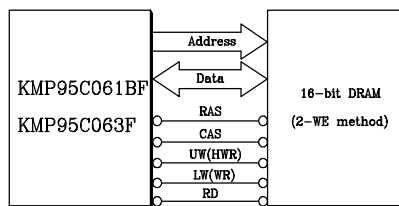
Additional functions

- Serial printers
- CD-ROMs
- Electronic musical instruments
- HDDs

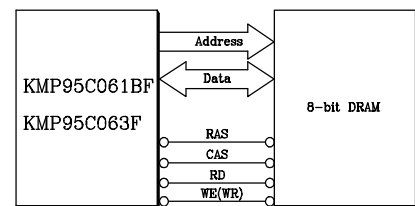
(a) 2-CAS method, 16-bit DRAM



(b) 2-WE method, 16-bit DRAM



(c) 8-bit DRAM



KLCS-900/H2 Series

High-performance microcontrollers incorporating a 32-bit CPU core

Full DRAM control functions

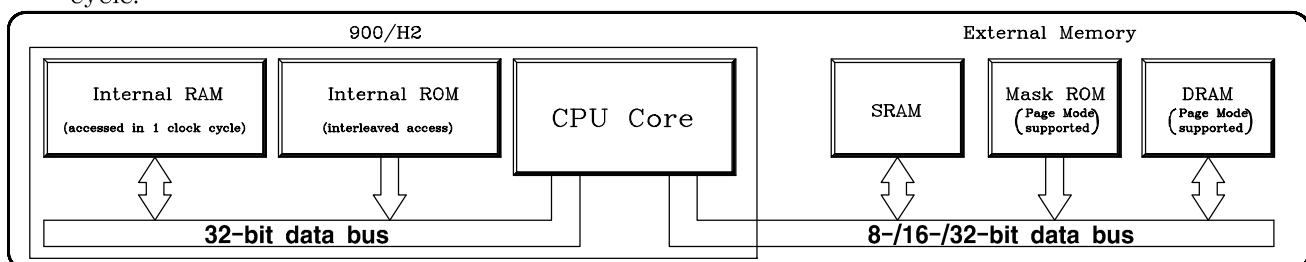
- Offers about 4times the processing performance of conventional products (900/H Series)
- **Enhanced high-speed data transfer function (micro DMA)**
 - : The 900/H2 Series microcontrollers com with a high-speed data transfer function, equivalent to that of a DMAC (direct memory access controller), as standard.

Function and performance comparison

	900, 900/L Series	900/H, 900/L1 Series	900/H2 Series
Number of chennels	4 channels	4 channels	8 channels
Minimum transfer	1600ns/ 2byte	640ns/ 2bytes	250ns/ 4bytes
Initiated by	interrupt	interrupt and software trigger	interrupt and software trigger
Continuous Transfer Mode	NA	NA	Available

Diverse memory types fully utilized

: The 900/H2 Series allows various kinds of external memory chip to be directly connected to the CPU core, without the need for an external circuit. Furthermore, the internal memory is connected to the CPU core via a 32-bit data bus and the internal RAM can be accessed in a single clock cycle.



16-bit Microcontrollers

900 series Selection Guide

ROM (byte)	RAM (byte)	Product No.	Minimum Instruction Execution Time (μs)		SIO/UART	I ² C Bus/SIO	DRAM Controller	A/D Converter		8-Bit DA Converter	LCD Driver	VFT Driver	Timer Counter	16-bit Channels	8-bit Channels	Clock Timer	Time Base Counter	Pattern Generator	Stepping Motor Controller	14-Bit PWM Timer	8-Bit PWM Timer	CS/Wait Controller	VCR Servo Controller	Watchdog Timer	Dual Clock	I/O Port	Clock Gear	Operating Temperature (°C)	Built-in OTP	Package
			5V±10%	3V±10%																										

900 Series

NA	NA	KMP96C041BF	Note2	200	-	2	-	-	-	4	-	-	-	2	2	-	-	2	-	2	-	3	-	●	-	-	47	-40~85	-	QFP80 (14×20mm)
	1K	KMP96C141BF				2	-	-	-	4	-	-	-	2	2	-	-	2	-	-	-	3	-	●	-	-	47	-	-	
32K		KMP96CM40F				2	-	-	-	4	-	-	-	2	2	-	-	2	-	-	-	3	-	●	-	-	65	-	QFP80 (14×20mm)	
																												KMP96PM40F		

900/L Series

NA	2K	*KMP93CS41F/DF	320	2	-	-	-	-	8	-	-	-	-	2	2	-	-	2	-	2	-	3	-	●	●	●	61	-40~85	-	QFP100 (14×14mm)
	4K	KMP93CW41DF		2	-	-	-	-	8	-	-	-	-	2	2	-	-	2	-	-	-	3	-	●	●	●	61	-	QFP100 (14×14mm)	
	8K	KMP93C071F		-	1	2	1	-	10	-	-	-	●	1	5	-	●	-	-	-	3	-	●	●	●	69	-10~70	-	QFP120 (28×28mm)	
8K	1K	*KMP93C852F		320	-	6	-	-	-	-	-	-	-	-	-	-	-	4	-	-	3	-	●	-	●	88	-	-	QFP160 (28×28mm)	
32K	2K	KMP93CM40F	200	400	2	-	-	-	8	-	-	-	-	2	2	-	-	2	-	-	3	-	●	●	●	79	-	KMP93PS40F/DF	QFP100 (14×14mm)	
	2K	*KMP93CS20F		2	-	1	-	-	8	-	●	-	4	4	●	-	-	-	-	-	-	-	-	●	●	●	88	-40~85	*KMP93PW20F	QFP144 (16×16mm)
		KMP93CS32F		2	1	-	-	-	6	-	-	-	4	2	-	-	-	-	-	-	-	-	●	-	●	49	-	KMP93PW32F	QFP64 (14×14mm)	
		KMP93CS40F/DF		2	-	-	-	-	8	-	-	-	2	2	-	-	-	2	-	-	3	-	●	●	●	79	-	KMP93PS40F/DF	QFP100 (14×14mm)	
		KMP93CS42AF		2	-	-	-	-	5	-	-	-	2	2	-	-	-	2	-	-	3	-	●	-	●	80	-	KMP93PS42AF	QFP100 (14×14mm)	
		KMP93CS44F		2	-	1	-	-	8	-	-	-	4	2	-	-	-	-	-	-	-	-	●	●	●	62	-	KMP93PS44F	QFP80 (12×12mm)	
72K	1.8K	KMP93CT75F	250	-	-	1	1	-	10	-	-	●	1	5	-	●	-	-	-	3	-	●	●	●	85	-10~70	KMP93PT75F	QFP100 (14×20mm)		
	4K	KMP93CW40DF	200	320	2	1	-	1	-	8	-	-	2	2	-	-	2	-	-	2	3	-	●	●	●	79	-40~85	KMP93PW40DF	QFP100 (14×14mm)	
		KMP93CW46AF		5	-	-	-	-	8	-	-	-	2	2	-	-	-	2	-	-	3	-	●	●	●	79	-	KMP93PW46AF	QFP100 (14×14mm)	
		*KMP93CW44DF		2	-	1	-	-	8	-	-	-	4	2	-	-	-	-	-	-	-	-	●	●	●	62	-	*KMP93PW44DF	QFP80 (14×20mm)	

900/H Series

NA	NA	KMP95C001F	320	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	0	-20~70	-	QFP64 (14×14mm)
		KMP95C063F		2	-	-	2	-	8	2	-	-	8	2	-	-	2	-	-	-	4	-	●	-	-	91	-	QFP144 (20×20mm)	
	2K	KMP95C265F		3	-	-	-	-	8	2	-	-	8	2	-	-	-	-	-	-	4	-	●	-	-	55	-	-	QFP100 (14×14mm)
64K		KMP95CS64F		3	-	-	-	-	8	2	-	-	8	2	-	-	-	-	-	-	4	-	●	-	-	81	-	KMP95PW64F	QFP100 (14×14mm)
Note3 128K		*KMP95FW86F	200	-	3	-	-	-	12	-	-	-	3	-	-	-	-	3	-	-	3	-	●	-	-	77	-	-	QFP100 (22×22mm)
128K		*KMP95CW64F	160	400	3	-	-	-	8	2	-	-	8	2	-	-	-	-	-	-	4	-	●	-	-	81	-40~85	KMP95PW64F	QFP100 (14×14mm)
Note3 128K		*KMP95FW64F	160	-	3	-	-	-	8	2	-	-	8	2	-	-	-	-	-	-	4	-	●	-	-	81	-	-	QFP100 (14×14mm)

900/L1 Series

96K	3K	KMP91CU10F	-	250	3	-	-	-	8	-	-	-	8	2	-	-	-	-	3	-	-	-	-	-	-	-	80	-40~85	KMP91PW10F	QFP100 (14×14mm)
128K	4K	*KMP91CW12F	-	250	2	-	1	-	8	-	-	-	8	2	●	-	-	-	-	4	-	●	●	●	81	-	*KMP91CW12F			

900/H2 Series

NA	2K	KMP94C241F	50	-	2	-	2	-	8	2	-	-	4	4	-	-	-	-	-	-	6	-	●	-	-	64	-20~70	-	QFP160 (28×28mm)
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*: Under development

★: Samples available

Note 1: The suffix F in a product number denotes a quade flat package(QFP)

Note 2: Guaranteed minimum instruction execution time is 200ns when operating at temperatures of -20°C to 70°C, or 250ns when operating at temperatures of -40°C to 85°C.

Note 3: Flash E²PROM(USP 4,382,279 owned by BULL CP8)