

# ispMACH 4000

**The Industry's Fastest and Lowest Power CPLDs**

## New CPLD Architecture Couples SuperFAST Performance and Low Power

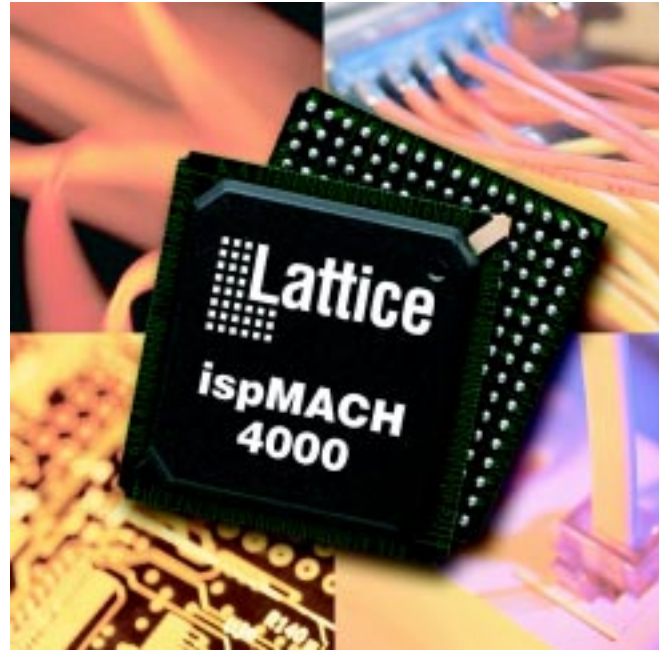
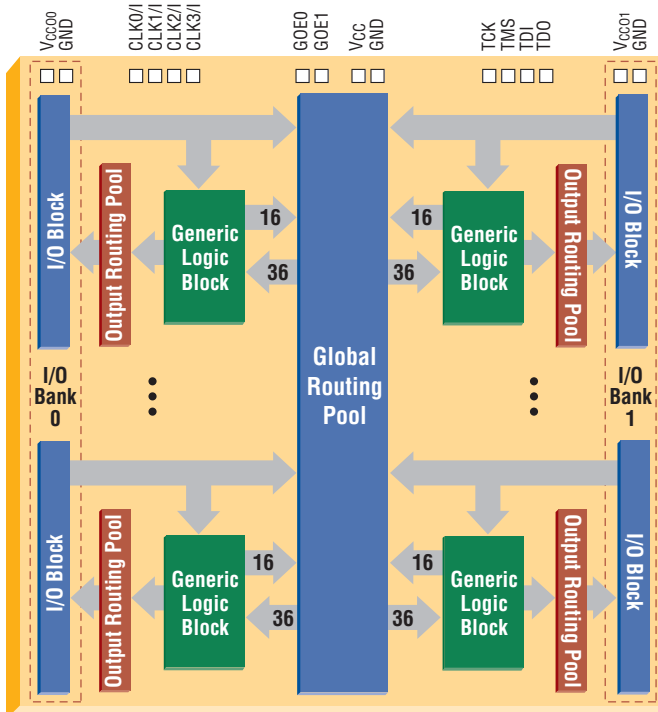
The ispMACH™ 4000 is the industry's fastest and lowest power ISP™ Complex Programmable Logic Device (CPLD) Family. With a SuperFAST™ 2.5ns pin-to-pin delay and low dynamic power, the ispMACH 4000 Family is the ultimate solution for high performance systems.

The ispMACH 4000 family contains two separate sub-families, supporting 2.5V (ispMACH 4000B), and the industry's first 1.8V CPLD family (ispMACH 4000C).

Utilizing Lattice's latest generation UltraMOS® process technology, the ispMACH 4000 architecture combines the best features of Lattice's ispMACH4A and ispLSI® 2000 families and provides high speed, low dynamic power consumption, enhanced logic control, and flexible I/O.

The new ispMACH 4000 Family is fully supported by Lattice's easy-to-use and powerful ispLEVER™ design software, plus a wide range of popular third-party tools. Designing with ispMACH 4000 devices is quick and easy using leading synthesis and simulation tools from Exemplar Logic, Synplicity and Model Technology.

## ispMACH 4000 Block Diagram

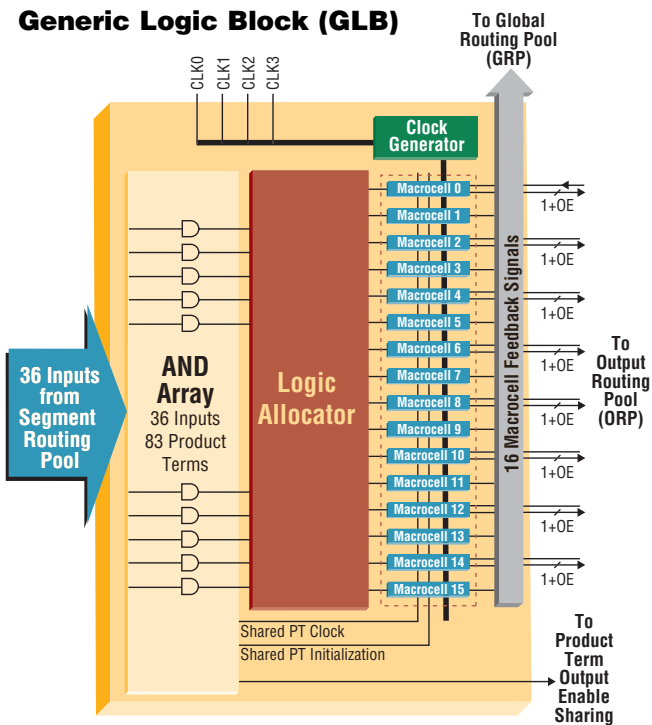


## Key Features and Benefits

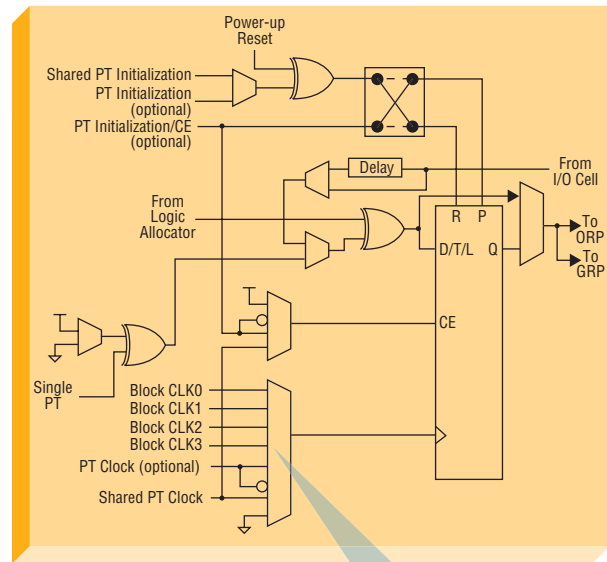
- **SuperFAST Performance**
  - 2.5 ns  $t_{PD}$  Pin-to-Pin Delay
  - 350 MHz System Performance
- **Industry's Lowest Power Consumption**
  - 1.8V Core for Low Dynamic Power
  - Low Static Current
    - 1-3.5 mA (1.8V ispMACH 4000B)
    - 9-11 mA (2.5V ispMACH 4000C)
- **Ease of Design**
  - Excellent First-Time Fit and Refit Capability
  - 4 Global Clocks
  - 36 Inputs per Logic Block
  - Up to 80 Product Terms (PT) per Output
  - ORP for Pin Locking
  - Density Migration
  - Flexible Control and Clocking
  - Enhanced OE Support
  - Fast, SpeedLocking™, and Wide PT Paths
- **Easy System Integration**
  - Operation with 1.8V and 2.5V Supplies
  - 1.8V, 2.5V, 3.3V I/O Support
  - IEEE 1532 In-System Programmable (ISP™)
  - IEEE 1149.1 Boundary Scan Test
  - Open Drain Output for Flexible Bus Interface Capability
  - Programmable Pull-Up or Bus-Keeper Inputs
  - Hot Socketing Capability
  - 3.3V PCI Compatible
  - Programmable Output Slew Rate

# ispMACH 4000 Architecture

## Generic Logic Block (GLB)



## Macrocell

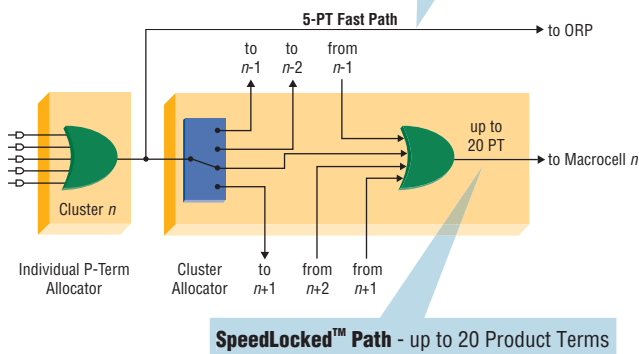


Flexible and efficient clock and control scheme ensures easy implementation with a variety of HDL coding styles.

## Flexible Product Term Allocation

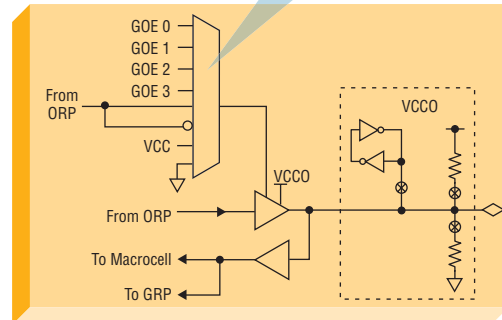
Fast Path and Speed Locked Path

SuperFAST 5 Product Term Fast Path for high performance functions



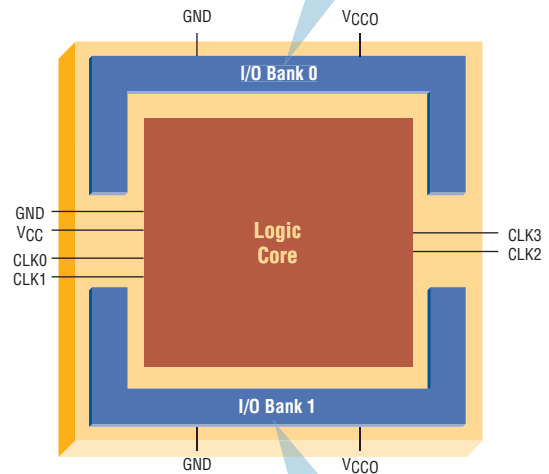
## I/O Cell

Enhanced Output Enable control selections for each I/O pin



## 1.8V/2.5V/3.3V Mixed Voltage Support

I/O Bank power supply can be 1.8V, 2.5V or 3.3V. Input standard supported is independent of V<sub>CC0</sub>.



Each I/O Bank has its own V<sub>CC0</sub> and GND

# ispMACH 4000 Applications

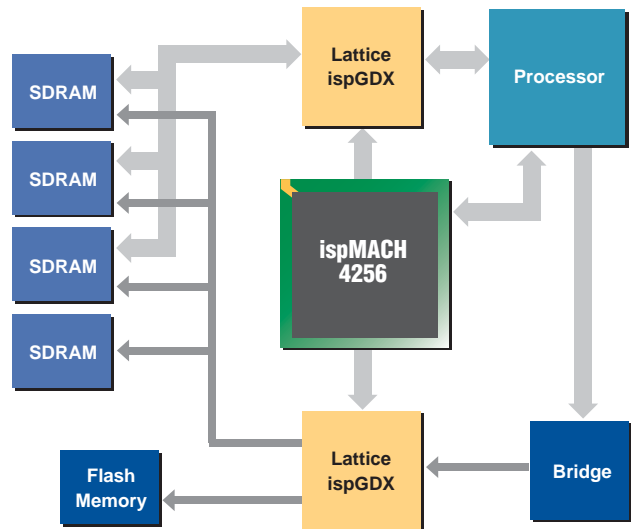
## Network Core Router

The SuperFAST performance of the ispMACH 4000 is perfect for implementing high speed data path and control applications. In this application, the ispMACH 4256 implements:

- MPC765 to SDRAM Data Pathway and Controller
- Finite State Machine
- JTAG Control
- MUX/DEMUX

### ispMACH 4000 Strengths

- High Density of I/Os
- Cost Effective
- Boundary Scan Improves Testability
- Design Simplicity



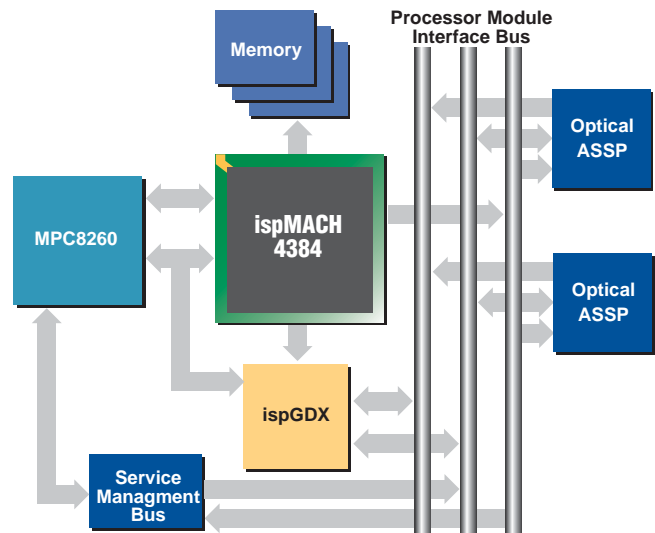
## Optical Transmission Processor Module

The ispMACH 4000 is an excellent solution for multi-voltage systems and high-speed bus applications. In this optical transmission application, the ispMACH 4384 performs:

- Complex Data Path Control
- Dedicated Interrupts
- Watchdog Timer
- LED/Alarm Controls
- Bus Arbitration Signals and Chip Selects for ASICs

### ispMACH 4000 Strengths

- Bus Speed
- Hot Socketing Capability
- Multi-Voltage Support
- Output Enable Control for each Pin



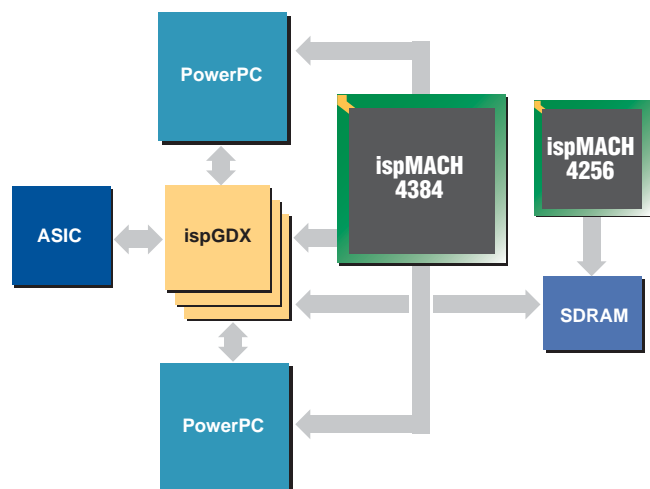
## OC12 Edge Router

The in-system programmability, non-volatility and very high speed of ispMACH 4000 devices make them a superior choice for interface applications. In this OC12 edge router application, the ispMACH 4384 performs the following functions:

- PowerPC™, ASIC and SDRAM Interface
- ispGDX® Data Flow Control
- CPU Control Registers
- SDRAM Controller
- Multiple Interface Options: DS3, OC-3, OC-12, Ethernet and Gigabit Ethernet

### ispMACH 4000 Strengths

- High Speed
- Package Migration
- In-System Programmable for Different Interface Options

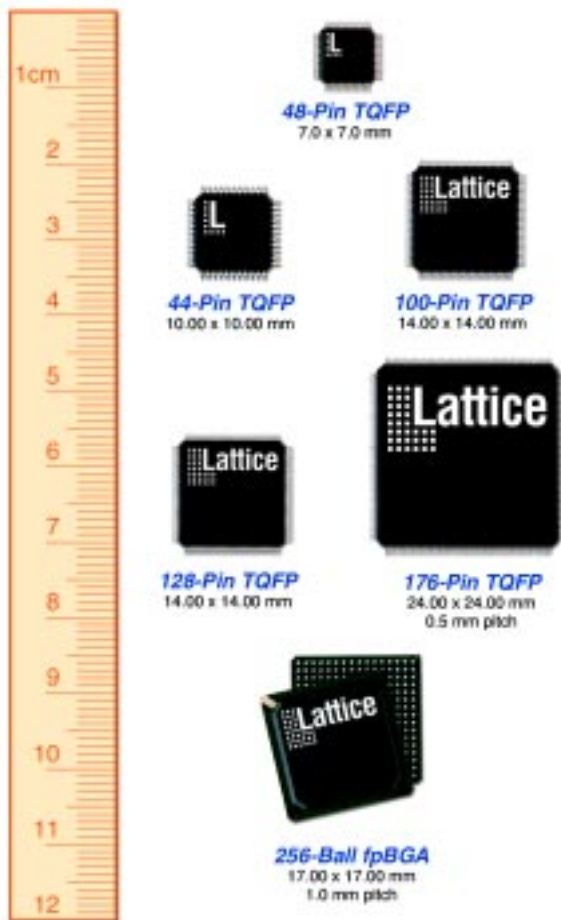


## ispMACH 4000 Family Attributes (Preliminary)

Family Member	Macrocells	User I/O Options	t <sub>PD</sub> (ns)	t <sub>CO</sub> (ns)	t <sub>S</sub> (ns)	f <sub>MAX</sub> (MHz)	V <sub>CC</sub>	Standby Power at 1.8V (mA)	Pins/Package
ispMACH 4032	32	30/32	2.5	2.5	1.75	350	1.8/2.5	1	44-pin TQFP 48-pin TQFP
ispMACH 4064	64	30/32/64	2.5	2.5	1.75	350	1.8/2.5	1.5	44-pin TQFP 48-pin TQFP 100-pin TQFP
ispMACH 4128	128	64/92	3.0	3.0	2.0	300	1.8/2.5	2	100-pin TQFP 128-pin TQFP
ispMACH 4256	256	64/128/160	3.0	3.0	2.0	300	1.8/2.5	2.5	100-pin TQFP 176-pin TQFP 256-ball fpBGA*
ispMACH 4384	384	128/192	3.5	3.5	2.5	250	1.8/2.5	3	176-pin TQFP 256-ball fpBGA
ispMACH 4512	512	128/208	3.5	3.5	2.5	250	1.8/2.5	3.5	176-pin TQFP 256-ball fpBGA

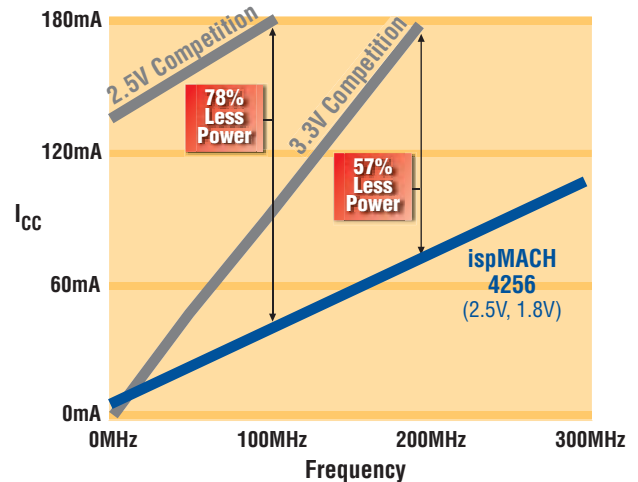
\* 128 and 160 I/O options

## ispMACH 4000 Advanced Packaging

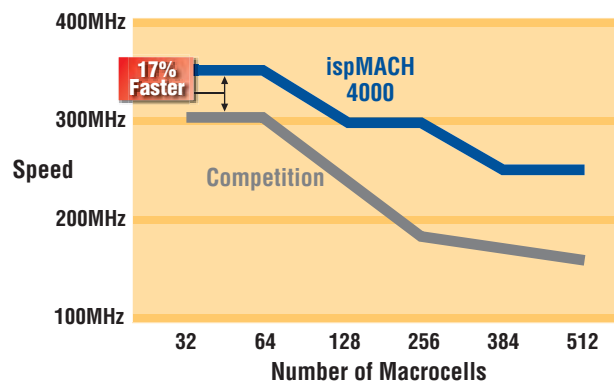


Packages are shown actual size. Dimensions refer to package body size.

## Industry's Lowest Power Consumption



## Superior Performance



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