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Understanding Embedded - DSP (Digital Signal Processors)

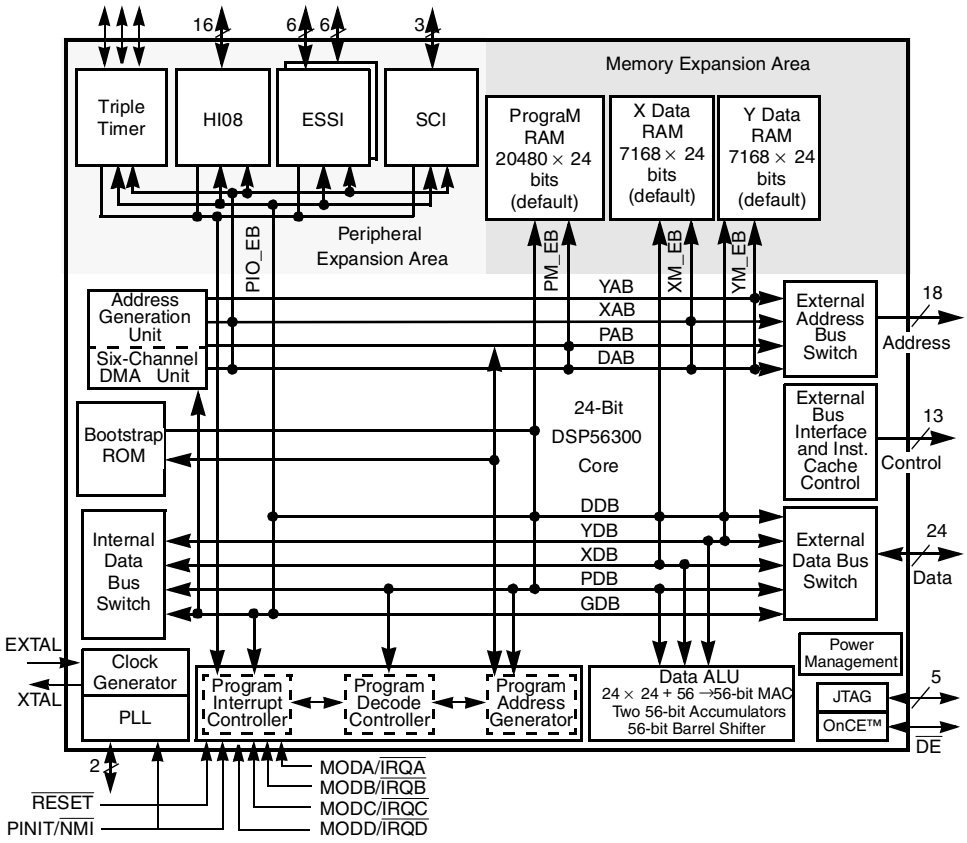
Embedded - DSP (Digital Signal Processors) are specialized microprocessors designed to perform complex mathematical computations on digital signals in real-time. Unlike general-purpose processors, DSPs are optimized for high-speed numeric processing tasks, making them ideal for applications that require efficient and precise manipulation of digital data. These processors are fundamental in converting and processing signals in various forms, including audio, video, and communication signals, ensuring that data is accurately interpreted and utilized in embedded systems.

Applications of Embedded - DSP (Digital Signal Processors)

Details	
Product Status	Obsolete
Type	Fixed Point
Interface	Host Interface, SSI, SCI
Clock Rate	100MHz
Non-Volatile Memory	ROM (576B)
On-Chip RAM	24kB
Voltage - I/O	3.30V
Voltage - Core	3.30V
Operating Temperature	-40°C ~ 105°C (TJ)
Mounting Type	Surface Mount
Package / Case	144-LQFP
Supplier Device Package	144-LQFP (20x20)
Purchase URL	https://www.e-xfl.com/product-detail/nxp-semiconductors/xc56309ag100ar2

DSP56309

24-Bit Digital Signal Processor



The DSP56309 is intended for applications benefiting from a large amount of internal memory, such as wireless infrastructure applications.

Figure 1. DSP56309 Block Diagram

The DSP56309 is a member of the DSP56300 core family of programmable CMOS DSPs. The DSP56300 core includes a barrel shifter, 24-bit addressing, an instruction cache, and direct memory access (DMA). The DSP56309 offers 100 million multiply-accumulates per second (MMACS) at 3.0–3.6 V using an internal 100 MHz clock. The large internal memory is ideal for wireless infrastructure and wireless local-loop applications. The DSP56300 core family offers a new level of performance in speed and power provided by its rich instruction set and low-power dissipation, thus enabling a new generation of wireless, multimedia, and telecommunications products.

Note: This document contains information on a new product. Specifications and information herein are subject to change without notice.

Features

Table 1 lists the features of the DSP56309 device.

Table 1. DSP56309 Features

<table>
<tr><th>Feature</th><th>Description</th></tr>
<tr><td>High-Performance DSP56300 Core</td><td>
• 100 million multiply-accumulates per second (MMACS) with a 100 MHz clock at 3.3 V nominal
• Data arithmetic logic unit (Data ALU) with fully pipelined 24 × 24-bit parallel multiplier-accumulator (MAC), 56-bit parallel barrel shifter (fast shift and normalization; bit stream generation and parsing), conditional ALU instructions, and 24-bit or 16-bit arithmetic support under software control
• Program control unit (PCU) with position-independent code (PIC) support, addressing modes optimized for DSP applications (including immediate offsets), internal instruction cache controller, internal memory-expandable hardware stack, nested hardware DO loops, and fast auto-return interrupts
• Direct memory access (DMA) with six DMA channels supporting internal and external accesses; one-, two- and three-dimensional transfers (including circular buffering); end-of-block-transfer interrupts; and triggering from interrupt lines and all peripherals
• Phase-lock loop (PLL) allows change of low-power divide factor (DF) without loss of lock and output clock with skew elimination
• Hardware debugging support including on-chip emulation (OnCE) module, Joint Test Action Group (JTAG) test access port (TAP)
</td></tr>
<tr><td>Internal Peripherals</td><td>
• Enhanced 8-bit parallel host interface (HI08) supports a variety of buses (for example, ISA) and provides glueless connection to a number of industry-standard microcomputers, microprocessors, and DSPs
• Two enhanced synchronous serial interfaces (ESSI), each with one receiver and three transmitters (allows six-channel home theater)
• Serial communications interface (SCI) with baud rate generator
• Triple timer module
• Up to thirty-four programmable general-purpose input/output (GPIO) pins, depending on which peripherals are enabled
</td></tr>
<tr><td>Internal Memories</td><td>
• 192 × 24-bit bootstrap ROM
• 8 K × 24-bit RAM total
• Program RAM, instruction cache, X data RAM, and Y data RAM sizes are programmable:
<table>
<tr><th>Program RAM Size</th><th>Instruction Cache Size</th><th>X Data RAM Size</th><th>Y Data RAM Size</th><th>Instruction Cache</th><th>Switch Mode</th></tr>
<tr><td>20480 × 24 bits</td><td>0</td><td>7168 × 24 bits</td><td>7168 × 24 bits</td><td>disabled</td><td>disabled</td></tr>
<tr><td>19456 × 24 bits</td><td>1024 × 24-bit</td><td>7168 × 24 bits</td><td>7168 × 24 bits</td><td>enabled</td><td>disabled</td></tr>
<tr><td>24576 × 24 bits</td><td>0</td><td>5120 × 24 bits</td><td>5120 × 24 bits</td><td>disabled</td><td>enabled</td></tr>
<tr><td>23552 × 24 bits</td><td>1024 × 24-bit</td><td>5120 × 24 bits</td><td>5120 × 24 bits</td><td>enabled</td><td>enabled</td></tr>
</table>
</td></tr>
<tr><td>External Memory Expansion</td><td>
• Data memory expansion to two 256 K × 24-bit word memory spaces using the standard external address lines
• Program memory expansion to one 256 K × 24-bit words memory space using the standard external address lines
• External memory expansion port
• Chip select logic for glueless interface to static random access memory (SRAMs)
• Internal DRAM Controller for glueless interface to dynamic random access memory (DRAMs)
</td></tr>
<tr><td>Power Dissipation</td><td>
• Very low-power CMOS design
• Wait and Stop low-power standby modes
• Fully static design specified to operate down to 0 Hz (dc)
• Optimized power management circuitry (instruction-dependent, peripheral-dependent, and mode-dependent)
</td></tr>
<tr><td>Packaging</td><td>
• 144-pin TQFP package in lead-free or lead-bearing versions
• 196-pin molded array plastic-ball grid array (MAP-BGA) package in lead-free or lead-bearing versions
</td></tr>
</table>

Target Applications

The DSP56309 is intended for applications benefiting from a large amount of internal memory, such as wireless infrastructure applications.

Product Documentation

The documents listed in **Table 2** are required for a complete description of the DSP56309 device and are necessary to design properly with the part. Documentation is available from a local Freescale distributor, a Freescale semiconductor sales office, or a Freescale Semiconductor Literature Distribution Center. For documentation updates, visit the Freescale DSP website. See the contact information on the back cover of this document.

Table 2. DSP56309 Documentation

Name	Description	Order Number
DSP56309 Technical Data	Description, features list, and specifications of the DSP56309	DSP56309
DSP56309 User's Manual	Detailed functional description of the DSP56309 memory configuration, operation, and register programming	DSP56309UM
DSP56300 Family Manual	Detailed description of the DSP56300 family processor core and instruction set	DSP56300FM
Application Notes	Documents describing specific applications or optimized device operation including code examples	See the DSP56309 product website

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DSP56309PB
Rev. 1
2/2005

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