

Plug-n-Play. An ISA Single Chip Device Solution

National Semiconductor
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The following material provides information on ISA bus Plug-n-Play architecture and National's solution for the same. National presently has two solutions for ISA adapters to enable them to be Plug-n-Play compliant. They are NM95MS14P and NM95MS15P. The objective of Plug-n-Play is to make ISA Adapters self configuring under the WINDOWS'95 operating system. National's solutions have both passed Microsoft's compliance test for Windows '95.

Apart from providing the Plug-n-Play solution, these two solutions also integrate on chip EEPROM to make the system solution, "Single chip". These two solutions have proven to be a popular choice amongst the ISA adapter vendors.

Availability of the devices as well as the support material are discussed inside.

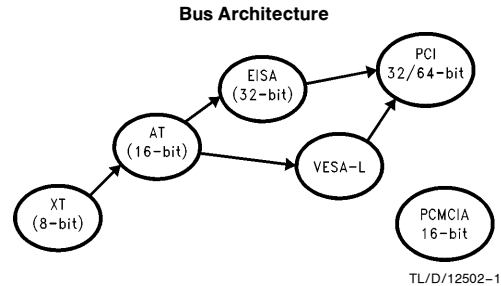
An Evaluation Board is also available, for vendors to get a "hands-on" on our solution.

For indepth technical information on Plug-n-Play architecture, please refer "ISA Plug-n-Play" specification 1.0a.

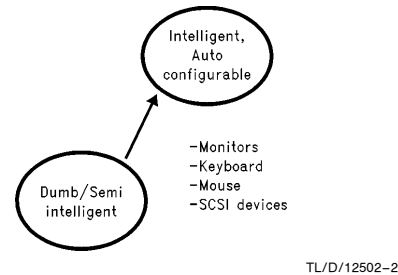
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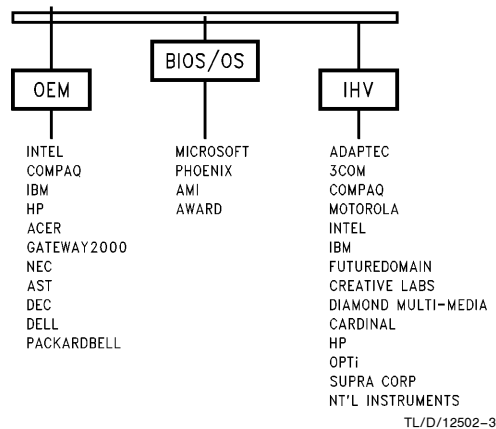
MARKET HISTORY



Peripheral Architecture



MAJOR PLAYERS IN PLUG-N-PLAY



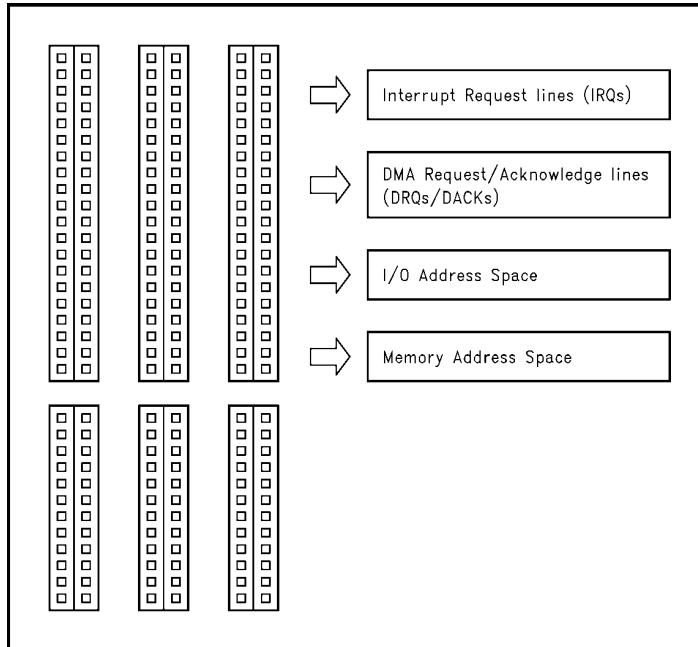
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TARGET MARKET

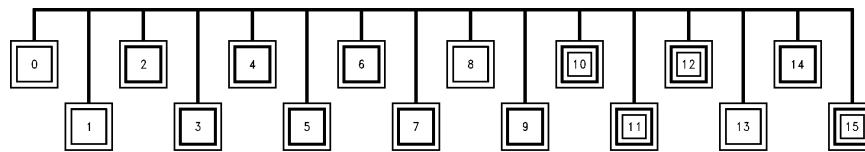
- ISA Adapters
 - SCSI Controller (HD, CD-ROM and FLOPPY)
 - Network Controller (LAN, WAN Ethernet®)
 - FAX-MODEM
 - Sound Card
 - Serial/Parallel Cards
 - Video (Display, Teleconf etc.)
 - Multimedia
 - I/O controller (IDE HD, CD-ROM and FLOPPY)

ISA BUS RESOURCE



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ISA BUS INTERRUPT



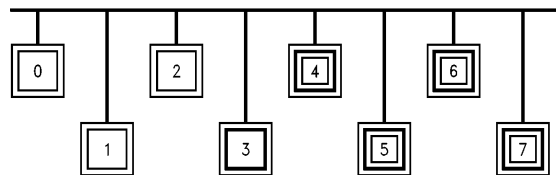
 Not Available on the ISA bus

 Have traditional usage

 Unassigned (Free)

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ISA BUS DMA CHANNELS



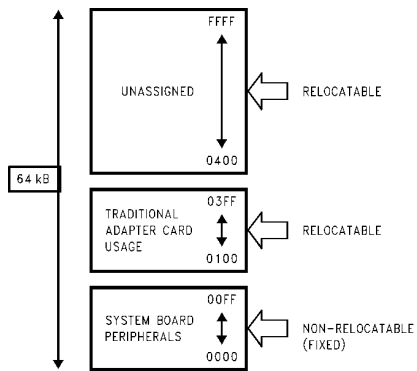
 Have traditional usage (8-bit)

 Unassigned (8-bit)

 Unassigned (16-bit)

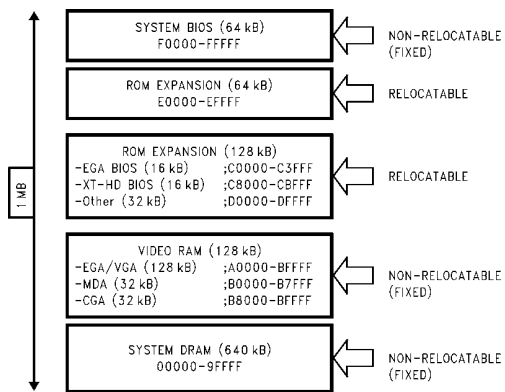
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ISA BUS I/O MAP



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ISA MEMORY MAP



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PLUG-N-PLAY—WHAT IS IT?

- Plug-n-Play is a new specification for Hardware and Software (BIOS and OS) which would enable all adapter cards/peripherals to be dynamically configured in-system without any manual intervention.
- Just Plug-Powerup-Play! !!

PLUG-N-PLAY DRIVERS

- Microsoft, Compaq, and Intel

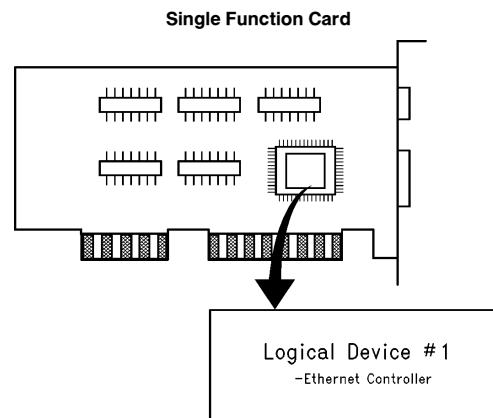
ELEMENTS OF PLUG-N-PLAY

Plug-n-Play specifies the necessary hardware logic that needs to be incorporated on add-on cards for automatic configuration (resource allocation).

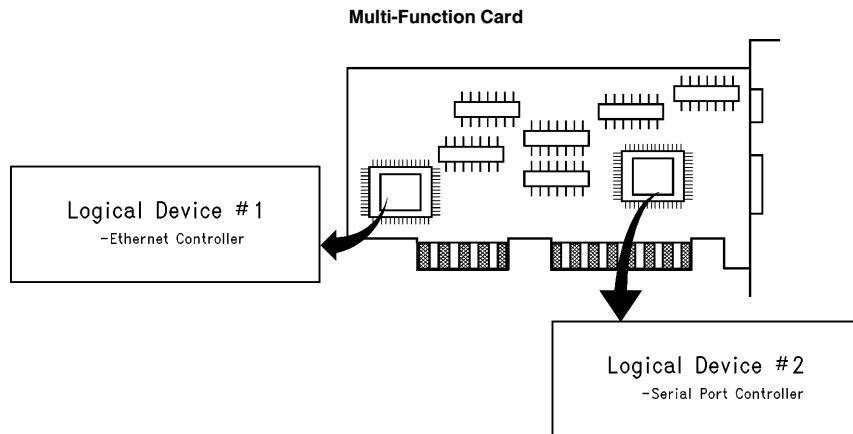
Plug-n-Play specifies the necessary software (BIOS and Device drivers) routines that needs to be implemented to access the above said logic in the add-on cards for automatic configuration.

Windows version 4.0 (Code named as "WINDOWS '95") will have built-in Plug-n-Play features with the specification fully incorporated. The standard is gaining widespread industry acceptance.

ISA ADAPTER TYPES



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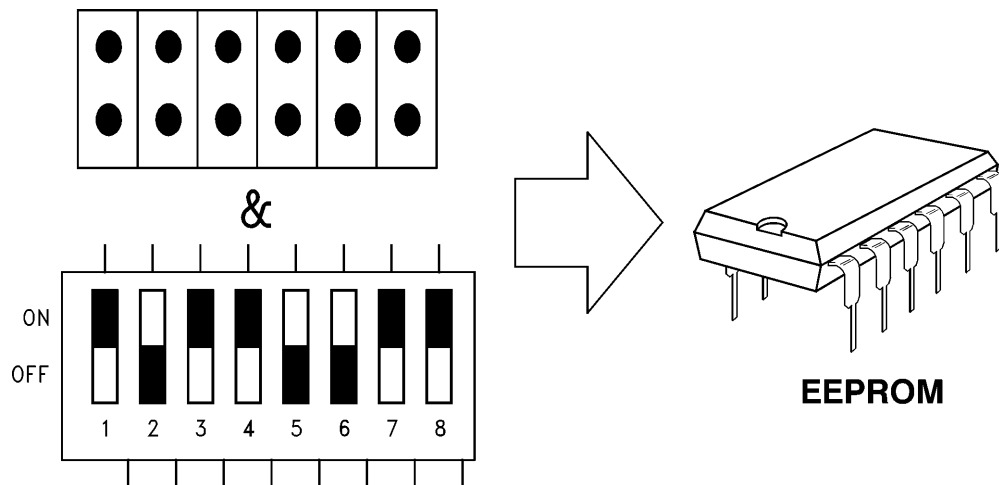
A WORD ABOUT "LEGACY DEVICES"

Pre-Plug-n-Play ISA adapter cards which require manual configuration through jumpers/switches are called "Legacy devices".

For some time, both Legacy devices and Plug-n-Play devices will co-exist.

Configuration of Legacy devices in a Plug-n-Play system is done via configuration utilities like Intel's ICU.

What Happens To Those Jumpers and Switches?

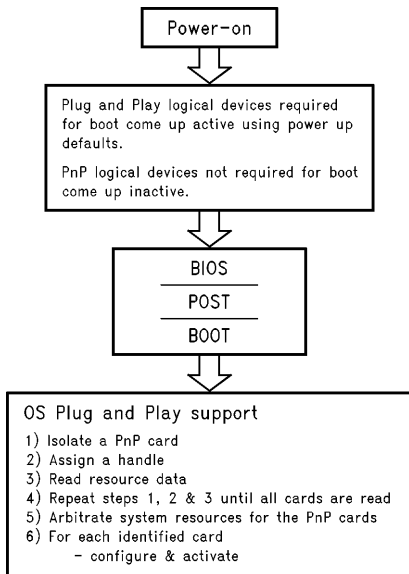


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RESOURCE CONFIGURATION DATA

- Contains information about the card, like . . .
The unique vendor ID (32-bit) + Serial ID (32-bit) of the card.
Plug-n-Play version number supported by the card (Currently 1.0a).
Description of the card (e.g., "NSC Ethernet controller").
Number of "logical devices" present on the card.
- Contains information about each logical device, like . . .
Number of ISA interrupt request required
Number of ISA interrupt channels incorporated on the card
Number of ISA DMA request required
Number of ISA DMA channels incorporated on the card
Number of address bits supported for I/O and memory space decode
I/O space base address required + number of I/O ports.
Memory space Base Address required + number of memory ports.
Relocatable address range for I/O space and memory space.

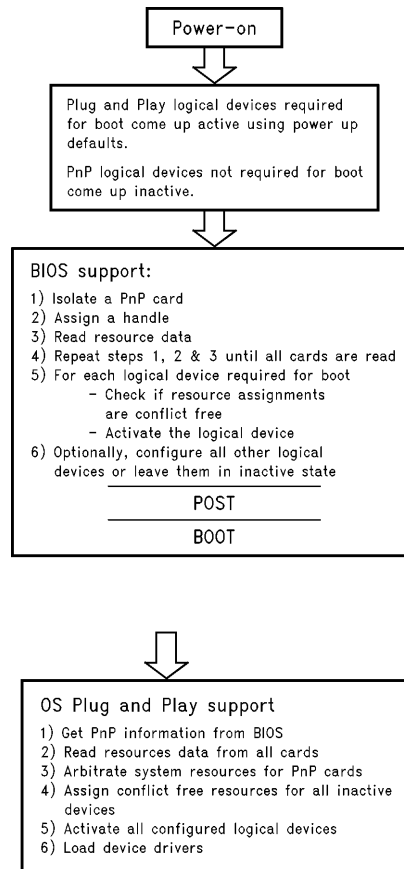
Plug-n-Play Mechanism—Case # 1



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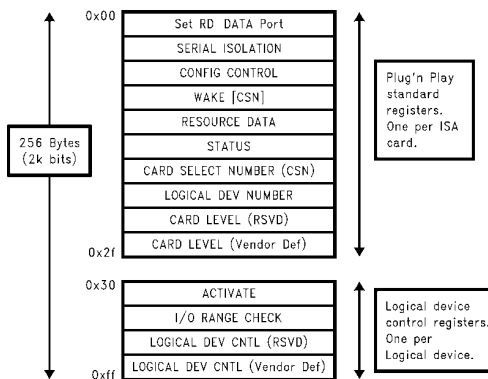
Configuration Flow for Existing Non-Plug and Play BIOS

Plug-n-Play Mechanism—Case # 2



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Plug-n-Play Registers



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Plug-n-Play Ports

Port Name	Location (Address)	Type
ADDRESS	0x0279 (Printer Status Port)	Write-Only
WRITE_DATA	0x0A79 (Printer Status Port + 0x0800)	Write-Only
READ_DATA	0x0203 to 0x3ff (Relocatable)	Read-Only

ACCESSING A PLUG-N-PLAY REGISTER

1. Selecting the Plug-n-Play register.
 - Write to address 0x279 with "Address of the Plug-n-Play register" as data. For e.g., to select "Config cntl" register, the data should be 0x02.
2. Writing to the Plug-n-Play register.
 - Write to address 0xA79 with the actual value to be written to that Plug-n-Play register.
 - Reading from the Plug-n-Play register
 - Read from the "READ-DATA" port (Note: The actual address of the READ-DATA port is previously determined).

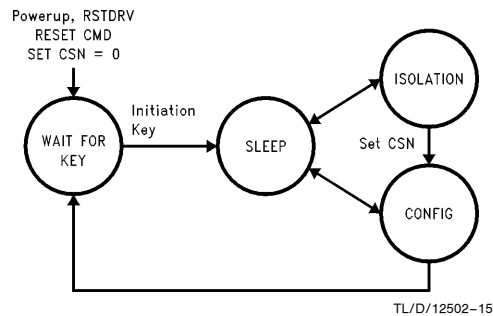
INITIATION KEY

- Plug-n-Play "Signature" cycles that let the Plug-n-Play-ISA adapters to detect Plug-n-Play configuration process.
- Initiation key is a series of 32 ISA write-cycles, with specific data-pattern on each write, made to the "ADDRESS PORT" (0x279).
- After power-up or reset, all Plug-n-Play-ISA cards will wait for this "Initiation Key" to happen on the ISA bus before responding any of the Plug-n-Play commands.

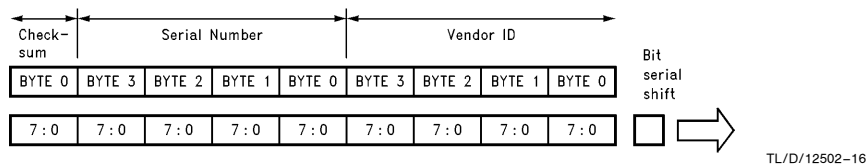
PLUG-N-PLAY COMMANDS

- Reset
- Wait for Key
- Reset CSN
- Set RD-Data Port
- Wake (CSN)

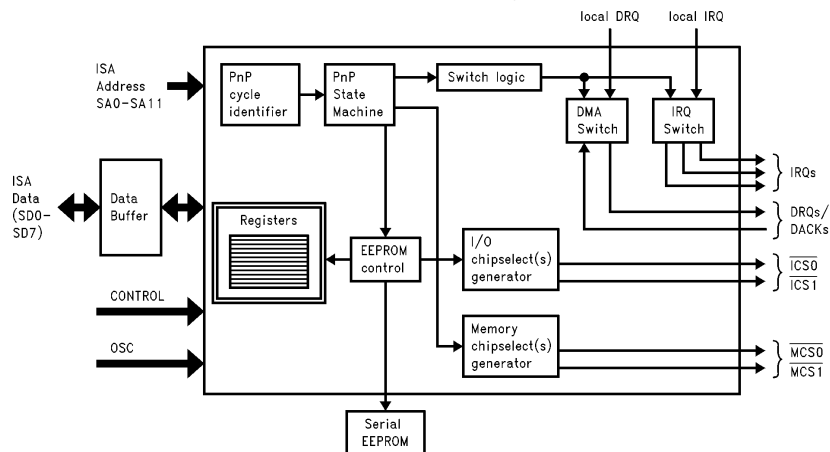
Plug-n-Play "States"



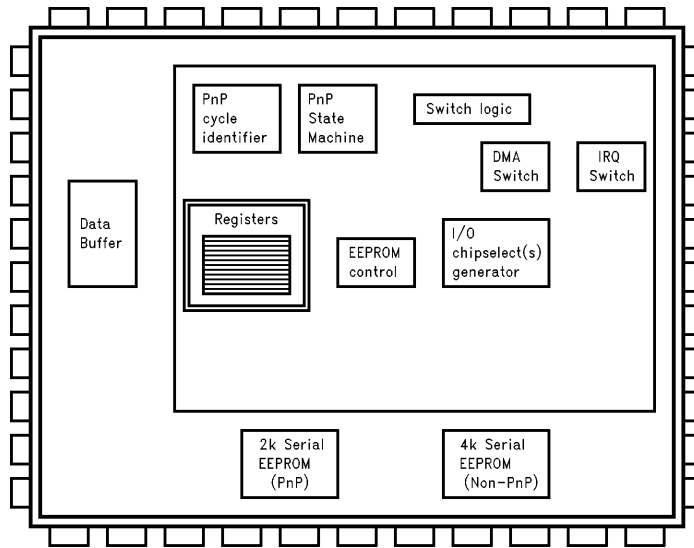
Isolation Process



Block Diagram of Plug-n-Play Logic

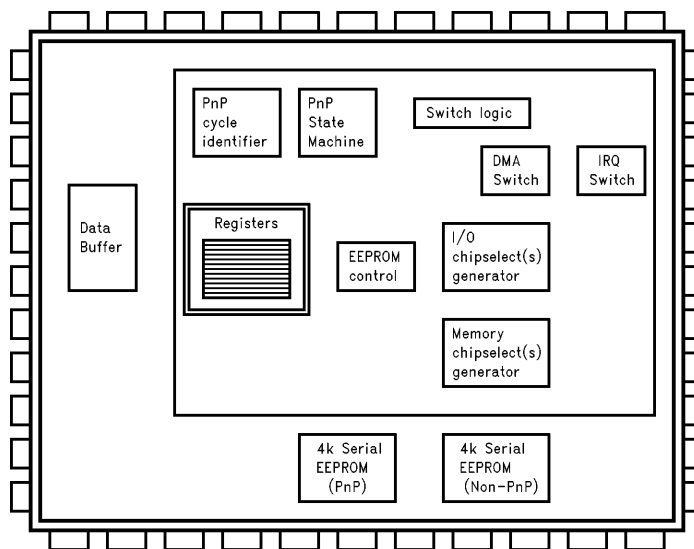


National's Offering . . . NM95MS14



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National's Offering . . . NM95MS15



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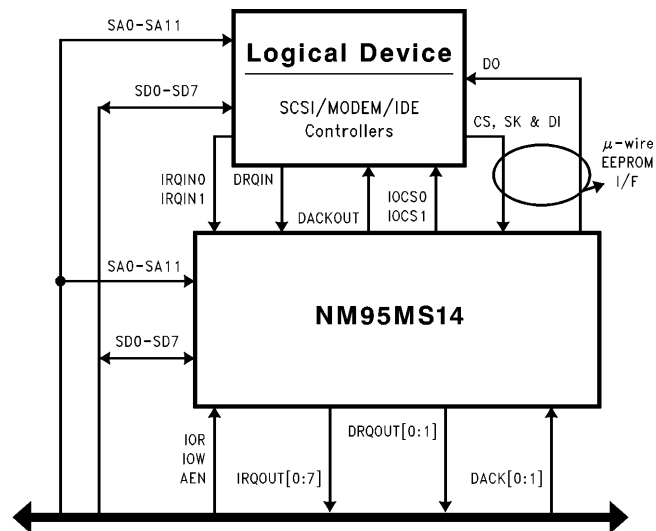
NM95MS14 FEATURES SUMMARY

- Supports 1 Logical device
- Two modes of operation
 - i) *DMA mode*:
 - 2 local/6 ISA IRQ support
 - 1 local/2 ISA DMA support
 - 2 I/O chipselects
 - 12 bit ISA address decode
 - ii) *Ext Intr mode*:
 - 2 local/8 ISA IRQ support
 - 4 I/O chipselects
 - 14 bit ISA address decode
- Onchip EEPROM
 - 2 Kbits for resource data
 - 4 Kbits for external usage
- 48-pin TQFP package

NM95MS15 FEATURES SUMMARY

- Supports 2 Logical device
- Three modes of operation
 - i) *DMA mode*:
 - 2 local/8 ISA IRQ support
 - 1 local/3 ISA DMA support
 - ii) *Ext Intr mode*:
 - 2 local/11 ISA IRQ support
 - iii) *Ext DMA mode*:
 - 2 local/8 ISA IRQ support
 - 2 local/3 ISA DMA support
- 20-bit ISA address decode
- 4 I/O chipselects
- 4 Memory chipselects
- Onchip EEPROM
 - 4 Kbits for resource data
 - 4 Kbits for external usage
- 64-pin TQFP package

Plug-n-Play Card Block Diagram (Typ)



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