

FUJITSU

## Bipolar Gate Array

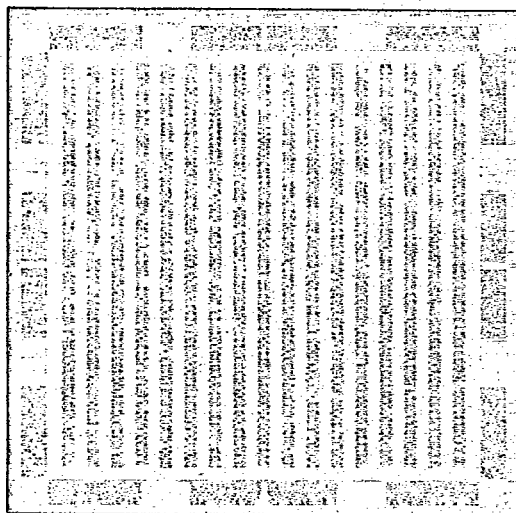
## GENERAL INFORMATION

The Fujitsu bipolar gate array family consists of five device types fabricated with low-power Schottky TTL (Transistor-Transistor-Logic) technology. The arrays contain from 240 to 2108 internal 3-input NAND gates and Input/Output buffers. With the application of a customized double-layer metal mask, the gates and buffers may be interconnected to form a wide variety of high density and high performance random logic configurations.

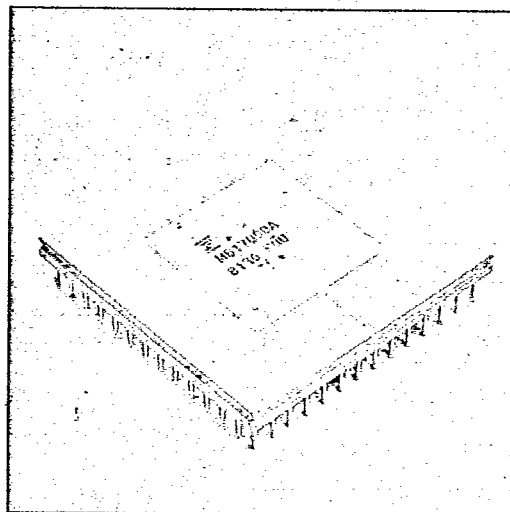
To reduce the design task of the customer, the functions

of standard SSI's and MSI's such as 74LS series are prepared as macros called "F-MACRO" in the library.

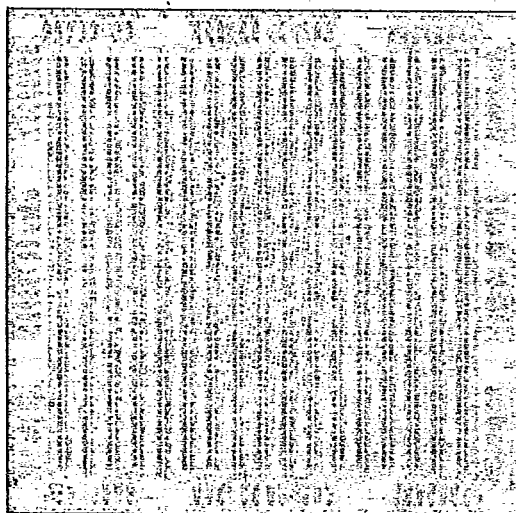
To assure quick, simple and error-free implementation of the metal interconnection routing, Fujitsu utilizes a unique Computer Aided Design (CAD) system to interface customer specification with the manufacturing function. This CAD software provides the physical layout of the array, line routing, mask pattern data generation and test programs, as well as computer simulation of the final circuit.



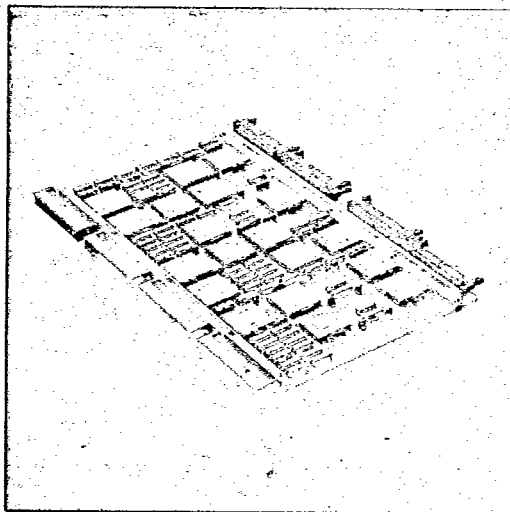
B-2000 Die, Before Metalization



RIT-135 Package



B-2000 Die, After Metalization



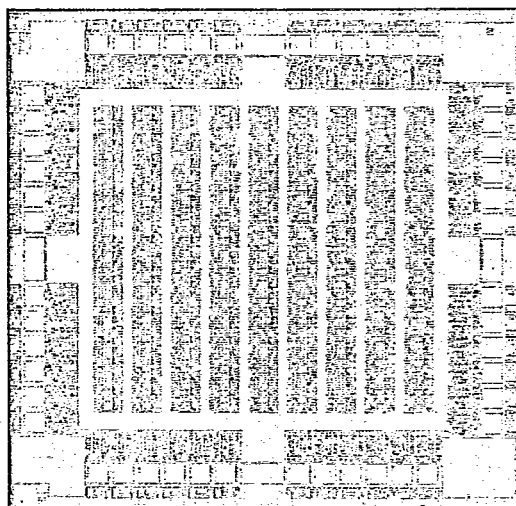
Fujitsu Gate Arrays, Replacing a Lot of MSI/SSI

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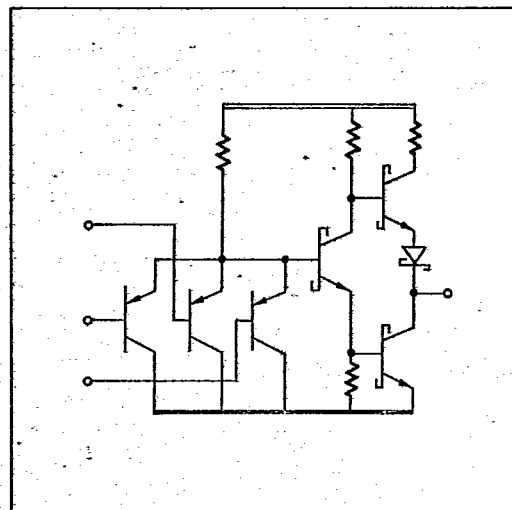
## Bipolar Gate Array

## FEATURES

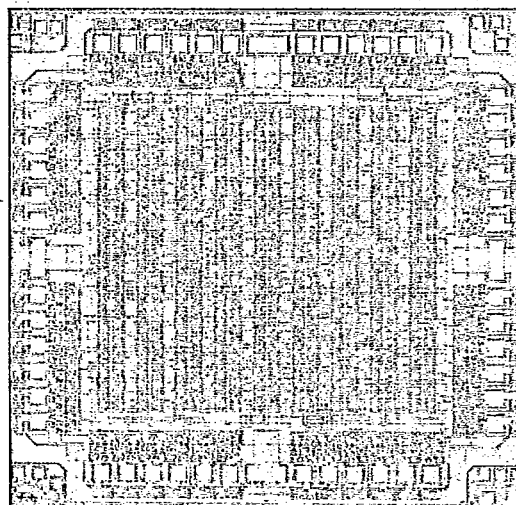
- Fast turn-around on design
- Replaces typically 30 to over 100 TTL SSI/MSI packages
- Simplified customer interface  
(only logic design and test pattern information required)
- Design support on major CAE workstations
- Fully supported by FUJITSU CAD system  
(logic validation, physical layout, metal interconnection and test program)
- Variety of software macros called "F-MACRO", equivalent to MSI functions
- Two speed versions, standard and high speed, available for the Logic Block Family of B-240, B-350, B-600, and B-1100.
- TTL Compatible Input/Output characteristics
- High-speed, low-power internal gate
- High input impedance input buffer with PNP transistor
- Four output buffer options  
(totem-pole, open-collector, 3-state, bidirectional)
- The B-240, B-350, B-600, B-1100 and B-2000 are alternate sourced by Texas Instruments Incorporated, USA and Monolithic Memories Incorporated, USA.



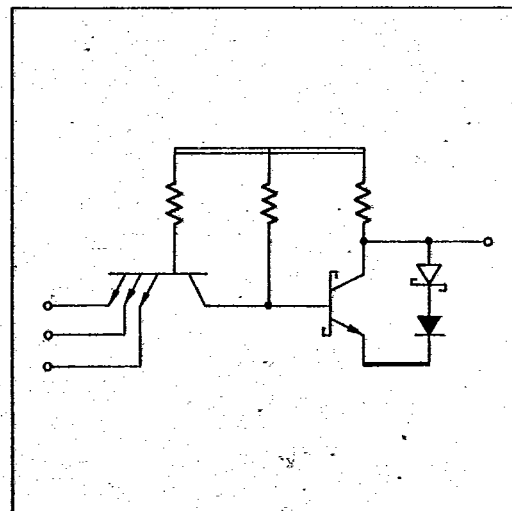
B-350 Die, Before Metalization



Internal Basic Gate Schematic for B-240, B-350, B-600 and B-1100



B-350 Die, After Metalization



Internal Basic Gate Schematic for B-2000



# Bipolar Gate Array

## DEVICE DESCRIPTION

| Device Name | Part Number           | Complexity <sup>1</sup> | Cell <sup>2</sup> Propagation Delay                                | Max. Number of Signal Pins | Output Options                                           | Supply Voltage                | Operating Temp. Range |
|-------------|-----------------------|-------------------------|--------------------------------------------------------------------|----------------------------|----------------------------------------------------------|-------------------------------|-----------------------|
| B-240       | MB 111 $\Delta^5$ xxx | 240 gates               | 1.65 ns (Standard) <sup>6</sup><br>1.0 ns (H-version) <sup>6</sup> | 40                         | Totem pole<br>Open-collector<br>3-state<br>Bidirectional | 5V $\pm$ 5%                   | 0 to 70°C             |
| B-350       | MB 112 $\Delta^5$ xxx | 360 gates               |                                                                    | 48                         |                                                          |                               |                       |
| B-600       | MB 113 $\Delta^5$ xxx | 616 gates               |                                                                    | 64                         |                                                          |                               |                       |
| B-1100      | MB 114 $\Delta^5$ xxx | 1120 gates              |                                                                    | 88                         |                                                          |                               |                       |
| B-2000      | MB 17xxx              | 2108 gates              | 0.95 ns                                                            | 112                        |                                                          | 5V $\pm$ 5%<br>2.3 $\pm$ 0.2V |                       |

1: 3-input NAND equivalent.

2: 3-input NAND, Ring Oscillator, F/O = 1.

3: From the customer's design approval to engineering sample shipment.

4:  $I_{OL} = 24mA$  is possible with a certain restriction on pin assignment.

5:  $\Delta$  will be "S", "T" or "F" depending on the number of power supply and ground pins.

6: Two speed versions, standard and high speed (H-version), available.

## PACKAGE OPTIONS

| Device Name | DIP-14 | DIP-16 | DIP-18 | DIP-20 | DIP-22 | DIP-24 | DIP-28 | DIP-40 | DIP-42 |
|-------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| B-240       | ■      | ◆ ■    | ◆ ■    | ◆ ■    | ◆ ■    | ◆ ■    | ◆ ■ I  | ◆ ■    | ■ I    |
| B-350       |        |        |        |        | ◆ ■    | ◆ ■    | ◆ ■ I  | ◆ ■    | ■ I    |
| B-600       |        |        |        |        |        | ◆ ■    | ◆ ■    | ◆ ■    | ◆ ■ I  |
| B-1100      |        |        |        |        |        |        |        |        |        |
| B-2000      |        |        |        |        |        |        |        |        |        |

◆ : Ceramic

■ : Plastic

I : Plastic (Shrink type DIP: Lead spacing center to center: 0.07")

## Bipolar Gate Array

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| Power Dissipation                                                                               | DC Characteristics                 |                                                             |                       |                      |                        | Normal <sup>3</sup><br>Max<br>Turn-around<br>Time | Device<br>Name |
|-------------------------------------------------------------------------------------------------|------------------------------------|-------------------------------------------------------------|-----------------------|----------------------|------------------------|---------------------------------------------------|----------------|
|                                                                                                 | Output High<br>Voltage             | Output Low<br>Voltage                                       | Input High<br>Voltage | Input Low<br>Voltage | Input Clamp<br>Voltage |                                                   |                |
| 0.8mW/gate<br>typ.<br>(Standard) <sup>6</sup><br>1.2mW/gate<br>typ.<br>(H-version) <sup>6</sup> | 2.4V (min) at<br>$I_{OH} = -3.3mA$ | 0.5V (max) at<br>$I_{OL} = 10mA$<br>or<br>$I_{OL} = 24mA^4$ | 2.0V (min)            | 0.8V (max)           | -1.5V<br>at 18mA       | 6 weeks                                           | B-240          |
|                                                                                                 |                                    |                                                             |                       |                      |                        | 6 weeks                                           | B-350          |
|                                                                                                 |                                    |                                                             |                       |                      |                        | 6 weeks                                           | B-600          |
|                                                                                                 |                                    |                                                             |                       |                      |                        | 6 weeks                                           | B-1100         |
| 0.65mW/gate<br>typ.                                                                             | 2.4V (min) at<br>$I_{OH} = -2.6mA$ | 0.5V (max) at<br>$I_{OL} = 8$ or 16mA                       |                       |                      | -1.5V<br>at 18mA       | 8 weeks                                           | B-2000         |

| DIP-48 | DIP-64 | FPT-28 | FPT-48 | PLCC<br>44 | PLCC<br>68 | RIT-64 | RIT-88 | RIT-107 | RIT-135 | Device Name |
|--------|--------|--------|--------|------------|------------|--------|--------|---------|---------|-------------|
| ■      |        | ■      | ■      | ■          |            |        |        |         |         | B-240       |
| ■      | ■      |        | ■      | ■          |            | ◆      |        |         |         | B-350       |
| ◆      | ■      |        | ■      | ■          | ■          | ◆      | ◆      |         |         | B-600       |
|        |        |        |        |            |            | ◆      | ◆      | ◆       |         | B-1100      |
|        |        |        |        |            |            |        |        | ◆       | ◆       | B-2000      |

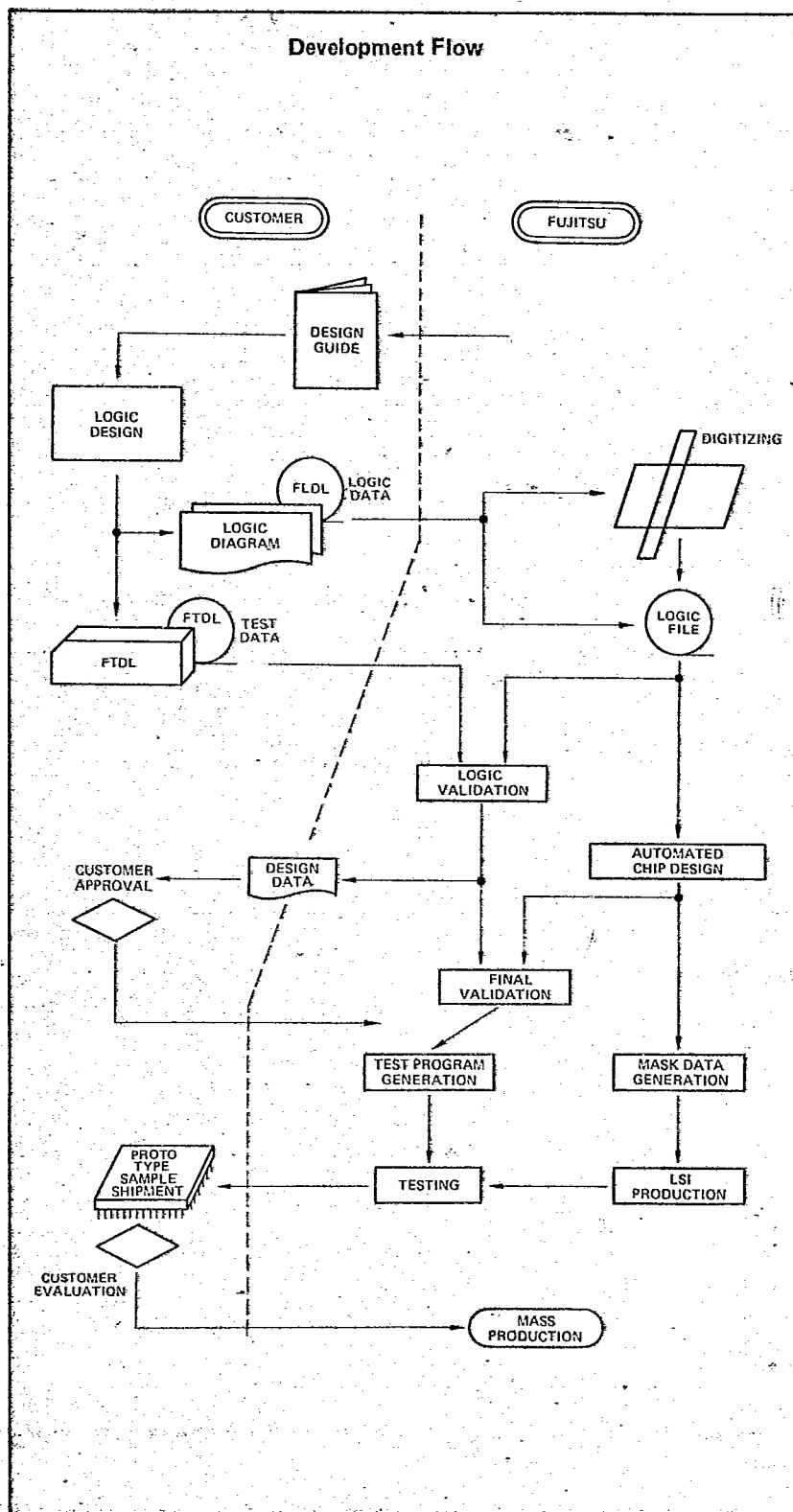
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## Bipolar Gate Array

## CUSTOMER/FUJITSU INTERFACE

In designing a custom LSI, there is a well-known sequence of customer and supplier activities, which are prerequisites to successful definition and delivery of the final product. These include logic design, specification of minimal timing restrictions, digitizing, layout, checkout, iterations, rework, multi-mask fabrication, test program generation and final part approval. Many of these tasks are eliminated, or at least simplified, by use of Fujitsu gate arrays. There are only two data inputs required from the customer: logic data and test pattern data both prepared in Fujitsu format. These logic data define the function performed by the gate array. Fujitsu has designed many types of logic functions which are made up of combinations of the basic 3-input NAND gates. The only restriction of these logic function cells is that the design does not exceed the total number of basic 3-input NAND gates contained in each bipolar gate array. The test data simply defines the functional relationship and AC requirement between the input and output pins of the circuit. This assures that the computerized layout for the interconnect metal mask accommodates the maximum time-delay caused by the metal mask line routing.

Furthermore, with both logic and test pattern data, Fujitsu performs logic validation for error-free design of the bipolar gate arrays. An interconnect layout is produced to verify AC performance and a final test program is generated. An interconnect metal mask can then be fabricated for the final processing of wafers. Within a short time after customer approval Fujitsu can deliver prototype samples.

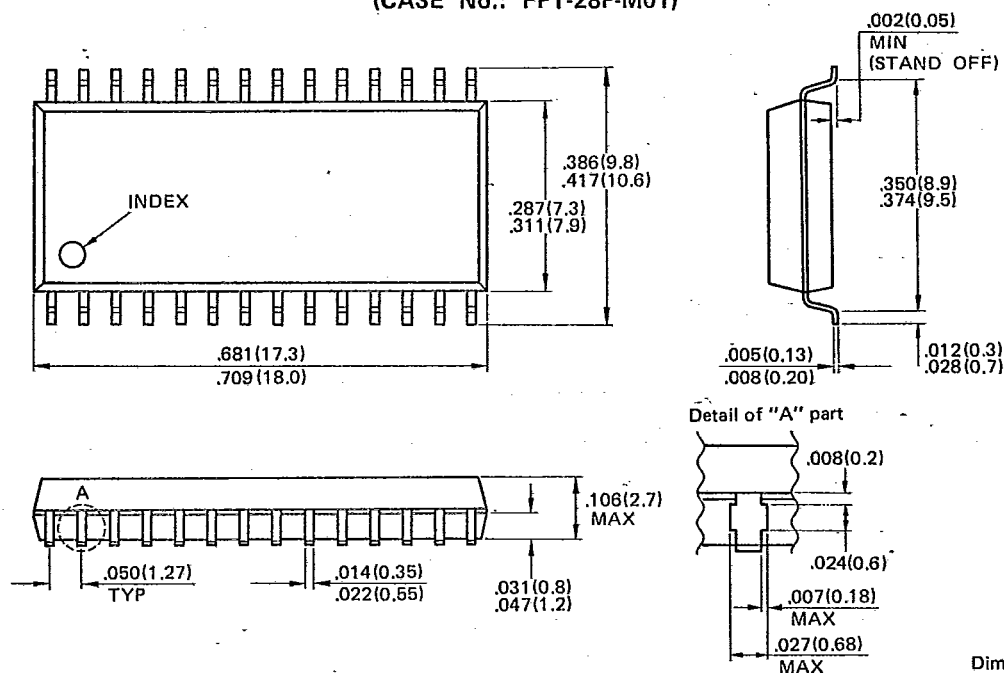


## Bipolar Gate Array



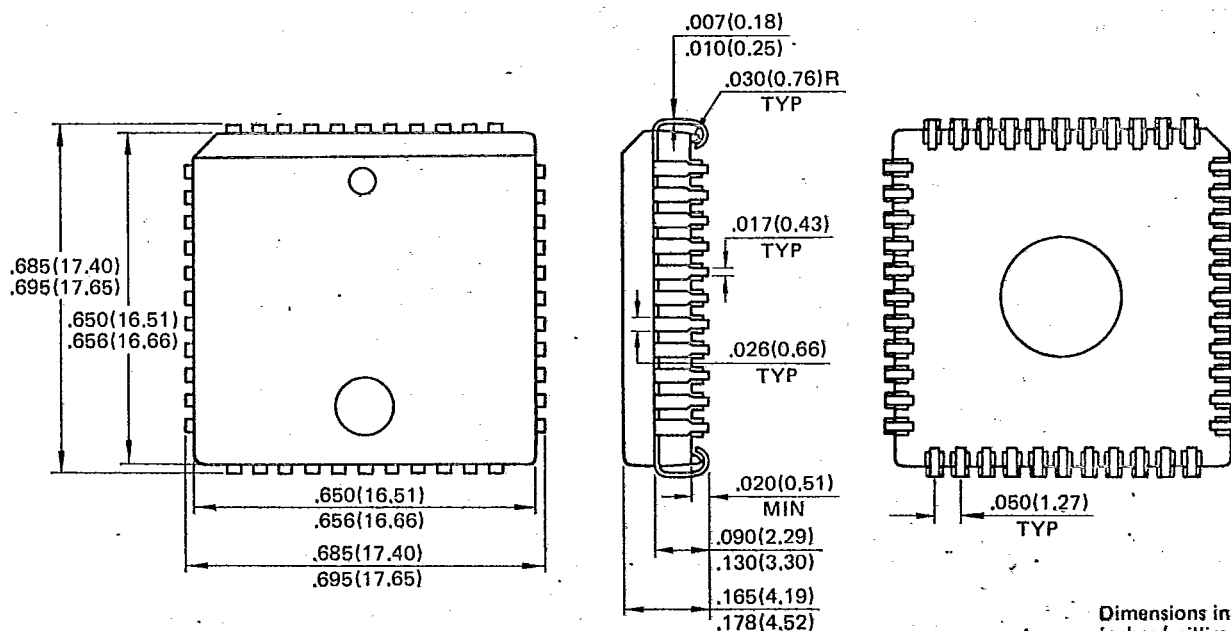
## PACKAGE DIMENSIONS

28-LEAD PLASTIC FLAT PACKAGE  
(CASE No.: FPT-28P-M01)



Dimensions in  
inches (millimeters)

44-LEAD PLASTIC CHIP CARRIER  
(CASE No.: LCC-44P-M01)

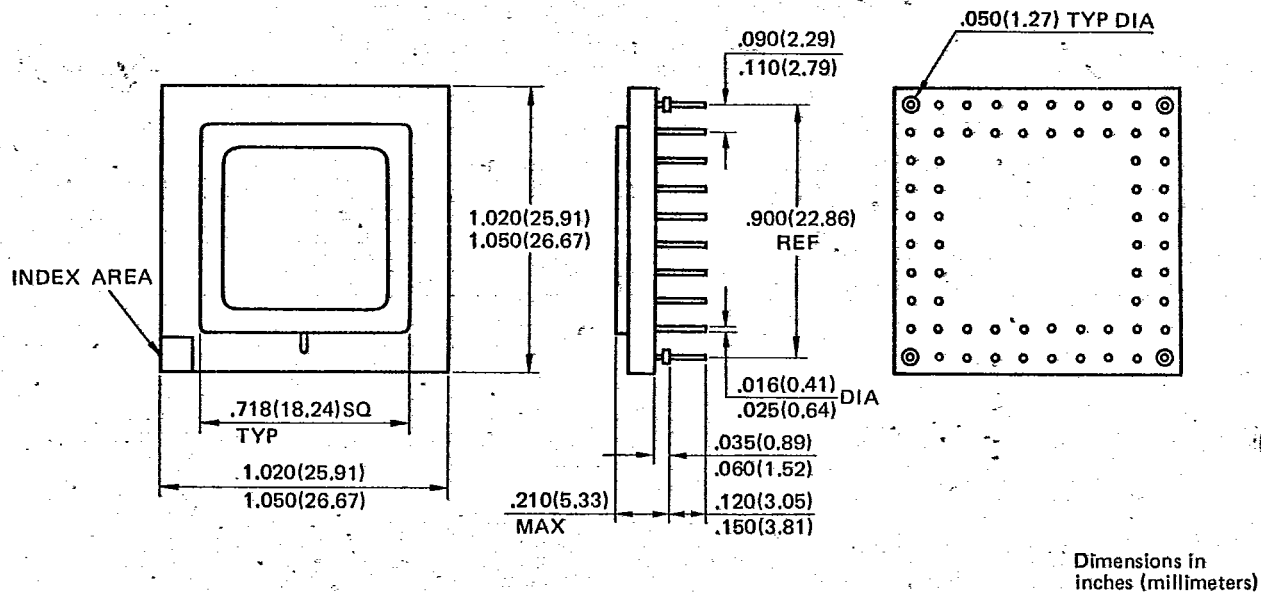
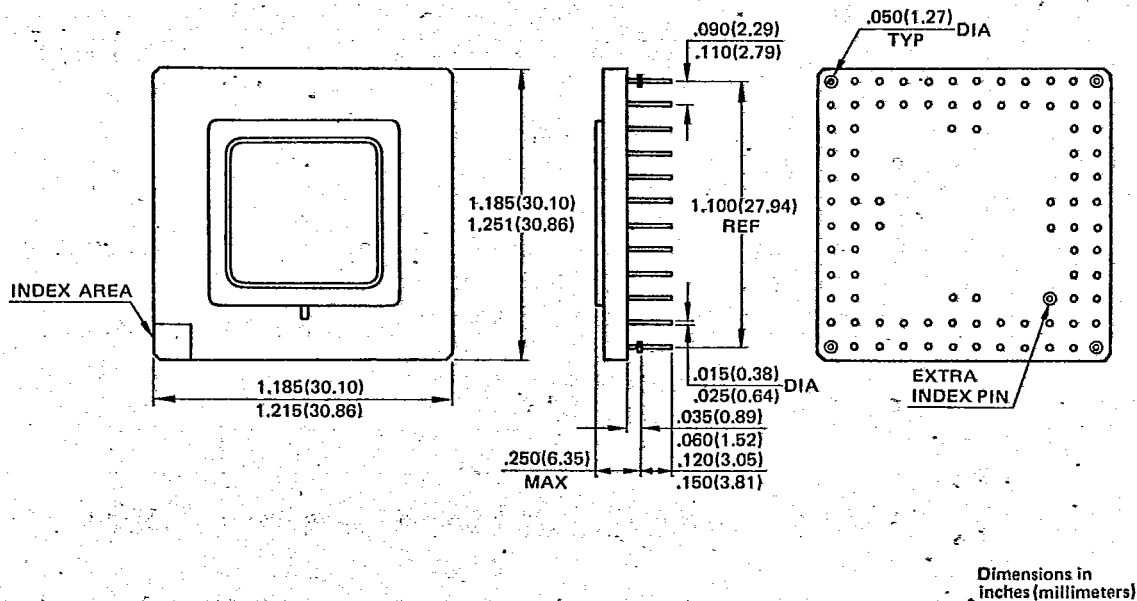


Dimensions in  
inches (millimeters)

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## Bipolar Gate Array

## PACKAGE DIMENSIONS (cont'd)

64-LEAD CERAMIC (METAL SEAL) REPEATED QUAD IN-LINE PACKAGE  
(CASE No.: RIT-64C-A01)88-LEAD CERAMIC (METAL SEAL) REPEATED QUAD IN-LINE PACKAGE  
(CASE No.: RIT-88C-A02)

## Bipolar Gate Array

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## LOGIC BLOCK FAMILY

## Internal Logic Block Family

| Name | Function                                   | B-240, B-350<br>B-600, B-1100 | B-2000 |
|------|--------------------------------------------|-------------------------------|--------|
| ST0  | Stuck at "L"                               | •                             | •      |
| ST1  | Stuck at "H"                               | •                             | •      |
| PU1  | Pull up Booster                            |                               | •      |
| PU2  | Pull up Booster                            |                               | •      |
| N01  | Inverter                                   | ■1•                           | •      |
| N02  | 2-input NAND                               | ■1•                           | •      |
| N03  | 3-input NAND                               | ■1•                           | •      |
| N04  | 4-input NAND                               | ■1•                           | •      |
| N05  | 5-input NAND                               | ■1•                           | •      |
| N06  | 6-input NAND                               | ■1•                           | •      |
| N07  | 7-input NAND                               | ■1•                           | •      |
| N08  | 8-input NAND                               | ■1•                           | •      |
| N09  | 9-input NAND                               | ■1•                           | •      |
| N10  | 10-input NAND                              | ■1•                           | •      |
| N11  | 11-input NAND                              | ■1•                           | •      |
| N12  | 12-input NAND                              | ■1•                           | •      |
| A01  | 1-input AND                                | ■1•                           | •      |
| A02  | 2-input AND                                | ■1•                           | •      |
| A03  | 3-input AND                                | ■1•                           | •      |
| A04  | 4-input AND                                | ■1•                           | •      |
| A05  | 5-input AND                                | ■1•                           | •      |
| A06  | 6-input AND                                | ■1•                           | •      |
| A07  | 7-input AND                                | ■1•                           | •      |
| A08  | 8-input AND                                | ■1•                           | •      |
| A09  | 9-input AND                                | ■1•                           | •      |
| A10  | 10-input AND                               | ■1•                           | •      |
| A11  | 11-input AND                               | ■1•                           | •      |
| A12  | 12-input AND                               | ■1•                           | •      |
| EOR2 | Exclusive OR                               | ■1•                           | •      |
| ENR2 | Exclusive NOR                              | ■1•                           | •      |
| AN22 | 2-input 2-wide AND-NOR                     | ■1•                           | •      |
| AN32 | 3-input 2-wide AND-NOR                     | ■1•                           | •      |
| AN42 | 4-input 2-wide AND-NOR                     | ■1•                           | •      |
| AN52 | 5-input 2-wide AND-NOR                     | ■1•                           | •      |
| AN62 | 6-input 2-wide AND-NOR                     | ■1•                           | •      |
| AN23 | 2-input 3-wide AND-NOR                     | ■1•                           | •      |
| AN33 | 3-input 3-wide AND-NOR                     | ■1•                           | •      |
| AN43 | 4-input 3-wide AND-NOR                     | ■1•                           | •      |
| AN53 | 5-input 3-wide AND-NOR                     | ■1•                           | •      |
| AN63 | 6-input 3-wide AND-NOR                     | ■1•                           | •      |
| AN24 | 2-input 4-wide AND-NOR                     | ■1•                           | •      |
| AN34 | 3-input 4-wide AND-NOR                     | ■1•                           | •      |
| AN44 | 4-input 4-wide AND-NOR                     | ■1•                           | •      |
| AN54 | 5-input 4-wide AND-NOR                     | ■1•                           | •      |
| AN64 | 6-input 4-wide AND-NOR                     | ■1•                           | •      |
| NR2  | 2-input NOR                                | ■1•                           | •      |
| NR3  | 3-input NOR                                | ■1•                           | •      |
| NR4  | 4-input NOR                                | ■1•                           | •      |
| LS1  | S-R Latch                                  | ■1•                           | •      |
| LS2  | Gated S-R Latch with Clear and Preset      | ■1•                           | •      |
| LD1  | D-Latch with Clear                         | ■1•                           | •      |
| LD2  | D-Latch with Clear and Preset              | ■1•                           | •      |
| LD3  | D-Latch with Clear and Preset              | ■1•                           | •      |
| FD1  | D-type Flip-Flop                           | ■1•                           | •      |
| FD2  | 2-wide 2-input D-type Flip-Flop            | ■1•                           | •      |
| FJ1  | J-XK Type Flip-Flop                        | ■1•                           | •      |
| FJ3  | J-XK Type Flip-Flop with 3 by 1 J-XK/CR/PR | ■1•                           | •      |
| FT1  | Toggle Flip-Flop                           | ■1•                           | •      |

Note: ■1 shows the availability of H-version (High speed version) Logic Block.

The Logic Block names of H-version are suffixed with "H". The 'H-version' of N02, for example, is named N02H.



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## Bipolar Gate Array

## Input/Output Buffer Family

| Name  | Function                                                                    | B-240, B-350<br>B-600, B-1100 | B-2000 |
|-------|-----------------------------------------------------------------------------|-------------------------------|--------|
| IC1   | Complementary 1-input Input Buffer                                          |                               | •      |
| IC1P  | Complementary 1-input Input Buffer with Input Pull-up                       |                               | •      |
| IA1   | 1-input AND Input Buffer                                                    | ■1 •                          | •      |
| IA1P  | 1-input AND Input Buffer with Input Pull-up                                 | •                             | •      |
| IN1   | 1-input NAND Input Buffer                                                   | ■1 •                          | •      |
| IN1P  | 1-input NAND Input Buffer with Input Pull-up                                | •                             | •      |
| IN1F  | 1-input, 2-output NAND Input Buffer                                         | •                             |        |
| IN1S  | Inverting Schmitt-Trigger Input Buffer                                      | •                             | •      |
| IC2   | Complementary 2-input Input Buffer                                          |                               | •      |
| IA2   | 2-input AND Input Buffer                                                    |                               | •      |
| IN2   | 2-input NAND Input Buffer                                                   |                               | •      |
| ON1   | 1-input NAND Output Buffer                                                  | • ♦2                          | • ♦2   |
| ON2   | 2-input NAND Output Buffer                                                  | • ♦2                          | • ♦2   |
| ON3   | 3-input NAND Output Buffer                                                  | • ♦2                          | • ♦2   |
| ON1O  | 1-input NAND Output Buffer (O/C type)                                       | • ♦2                          | • ♦2   |
| ON2O  | 2-input NAND Output Buffer (O/C type)                                       | • ♦2                          | • ♦2   |
| ON3O  | 3-input NAND Output Buffer (O/C type)                                       | • ♦2                          | • ♦2   |
| ON1T  | 1-input NAND Output Buffer (3-state output)                                 | • ♦2                          | • ♦2   |
| ON2T  | 2-input NAND Output Buffer (3-state output)                                 | • ♦2                          | • ♦2   |
| OA1   | 1-input AND Output Buffer                                                   | • ♦2                          | • ♦2   |
| OA2   | 2-input AND Output Buffer                                                   | • ♦2                          | • ♦2   |
| OA3   | 3-input AND Output Buffer                                                   | • ♦2                          | • ♦2   |
| OA1O  | 1-input AND Output Buffer (O/C type)                                        | • ♦2                          | • ♦2   |
| OA2O  | 2-input AND Output Buffer (O/C type)                                        | • ♦2                          | • ♦2   |
| OA3O  | 3-input AND Output Buffer (O/C type)                                        | • ♦2                          | • ♦2   |
| OA1T  | 1-input AND Output Buffer (3-state output)                                  | • ♦2                          | • ♦2   |
| OA2T  | 2-input AND Output Buffer (3-state output)                                  | • ♦2                          | • ♦2   |
| BN1C  | Bidirectional Buffer<br>Output: 1-input NAND, Input: 1-input Complementary  |                               | •      |
| BN2C  | Bidirectional Buffer<br>Output: 2-input NAND, Input: 1-input Complementary  |                               | •      |
| BN1A  | Bidirectional Buffer<br>Output: 1-input NAND, Input: 1-input AND            | •                             | •      |
| BN2A  | Bidirectional Buffer<br>Output: 2-input NAND, Input: 1-input AND            | •                             | •      |
| BN1N  | Bidirectional Buffer<br>Output: 1-input NAND, Input: 1-input NAND           | •                             | •      |
| BN2N  | Bidirectional Buffer<br>Output: 2-input NAND, Input: 1-input NAND           | •                             | •      |
| BN1NF | Bidirectional Buffer<br>Output: 1-input NAND, Input: 1-input, 2-output NAND | •                             |        |
| BN2NF | Bidirectional Buffer<br>Output: 2-input NAND, Input: 2-input, 2-output NAND | •                             |        |
| BA1C  | Bidirectional Buffer<br>Output: 1-input AND, Input: 1-input Complementary   |                               | •      |
| BA2C  | Bidirectional Buffer<br>Output: 2-input AND, Input: 1-input Complementary   |                               | •      |
| BA1A  | Bidirectional Buffer<br>Output: 1-input AND, Input: 1-input AND             | •                             | •      |
| BA2A  | Bidirectional Buffer<br>Output: 2-input AND, Input: 1-input AND             | •                             | •      |
| BA1N  | Bidirectional Buffer<br>Output: 1-input AND, Input: 1-input NAND            | •                             | •      |
| BA2N  | Bidirectional Buffer<br>Output: 2-input AND, Input: 1-input NAND            | •                             | •      |
| BA1NF | Bidirectional Buffer<br>Output: 1-input AND, Input: 1-input, 2-output NAND  | •                             |        |
| BA2NF | Bidirectional Buffer<br>Output: 2-input AND, Input: 1-input, 2-output NAND  | •                             |        |

Note: ■1 shows the availability of H-version (High speed version) Logic Block. The Logic Block names of H-version are suffixed with "H".  
 ♦2 shows the availability of Driver Output Buffers. The names of Driver Output Buffers are suffixed with "D".

## Bipolar Gate Array

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## F-MACRO FAMILY

| Name | Function Equivalent | Number of Basic Gates         |        |
|------|---------------------|-------------------------------|--------|
|      |                     | B-240, B-350<br>B-600, B-1100 | B-2000 |
| F00  | 74LS00              | 4                             | 4      |
| F02  | 74LS02              | 8                             | 8      |
| F04  | 74LS04              | 6                             | 6      |
| F08  | 74LS08              | 8                             | 8      |
| F10  | 74LS10              | 3                             | 3      |
| F11  | 74LS11              | 6                             | 6      |
| F20  | 74LS20              | 4                             | 4      |
| F21  | 74LS21              | 4                             | 4      |
| F25  | 7425                | 12                            | 12     |
| F27  | 74LS27              | 12                            | 12     |
| F30  | 74LS30              | 4                             | 4      |
| F32  | 74LS32              | 12                            | 12     |
| F42  | 74LS42              | 24                            | 34     |
| F43  | 7443A               | 24                            | 36     |
| F44  | 7444A               | 24                            | 36     |
| F51  | 74LS51              | 4                             | 4      |
| F54  | 74LS54              | 4                             | 6      |
| F55  | 74LS55              | 4                             | 4      |
| F56  | 74LS56              | 56                            | -      |
| F57  | 74LS57              | 52                            | -      |
| F64  | 74S64               | 8                             | 6      |
| F68  | 74LS68              | 62                            | 64     |
| F69  | 74LS69              | 52                            | 57     |
| F73  | 74LS73A             | 20                            | 20     |
| F74  | 74LS74A             | 12                            | 12     |
| F75  | 74LS75              | 20                            | 20     |
| F76  | 74LS76A             | 20                            | 20     |
| F77  | 74LS77              | 18                            | 18     |
| F78  | 74LS78A             | 19                            | 19     |
| F82  | 7482                | 19                            | 25     |
| F83  | 74LS83A             | 65                            | 75     |
| F85  | 74LS85              | 40                            | 52     |
| F86  | 74LS86              | 16                            | 16     |
| F87  | 74H87               | 26                            | 26     |
| F90  | 74LS90              | 34                            | 38     |
| F91  | 74LS91              | 52                            | 57     |
| F92  | 74LS92              | 32                            | 32     |
| F93  | 74LS93              | 27                            | 32     |
| F94  | 7494                | 33                            | 37     |
| F95  | 74LS95B             | 35                            | 40     |
| F96  | 74LS96              | 38                            | 43     |
| F97  | 7497                | 92                            | 109    |
| F98  | 54L98               | 34                            | 36     |
| F99  | 54L99               | 38                            | 41     |
| F100 | 74100               | 40                            | 46     |
| F101 | 74H101              | 14                            | 14     |
| F102 | 74H102              | 13                            | 13     |
| F103 | 74H103              | 20                            | 20     |
| F106 | 74H106              | 20                            | 20     |
| F107 | 74LS107             | 20                            | 20     |
| F108 | 74H108              | 19                            | 19     |
| F109 | 74LS109A            | 16                            | 16     |
| F112 | 74LS112A            | 20                            | 20     |
| F113 | 74LS113             | 20                            | 20     |
| F114 | 74LS114A            | 19                            | 19     |
| F116 | 74116               | 58                            | 48     |
| F120 | 74120               | 20                            | 20     |
| F135 | 74S135              | 32                            | 32     |
| F137 | 74LS137             | 35                            | 43     |
| F138 | 74LS138             | 24                            | 26     |
| F139 | 74LS139             | 14                            | 18     |
| F147 | 74LS147             | 35                            | 36     |

| Name | Function Equivalent | Number of Basic Gates         |        |
|------|---------------------|-------------------------------|--------|
|      |                     | B-240, B-350<br>B-600, B-1100 | B-2000 |
| F148 | 74LS148             | 34                            | 36     |
| F150 | 74150               | 46                            | 56     |
| F151 | 74LS151             | 25                            | 25     |
| F152 | 74LS152             | 23                            | 29     |
| F153 | 74LS153             | 14                            | 16     |
| F154 | 74154               | 44                            | 59     |
| F155 | 74LS155             | 15                            | 17     |
| F157 | 74LS157             | 15                            | 17     |
| F158 | 74LS158             | 10                            | 13     |
| F160 | 74LS160A            | 56                            | 61     |
| F161 | 74LS161A            | 54                            | 62     |
| F162 | 74LS162A            | 59                            | 62     |
| F163 | 74LS163A            | 58                            | 63     |
| F164 | 74LS164             | 56                            | 62     |
| F165 | 74LS165             | 70                            | 77     |
| F166 | 74LS166             | 73                            | 79     |
| F167 | 74LS167             | -                             | 61     |
| F168 | 74S168              | 82                            | 98     |
| F169 | 74LS169B            | 73                            | 82     |
| F171 | 74LS171             | 24                            | 30     |
| F174 | 74LS174             | 42                            | 44     |
| F175 | 74LS175             | 24                            | 30     |
| F176 | 74176               | 39                            | 45     |
| F177 | 74177               | 35                            | 40     |
| F178 | 74178               | 43                            | 47     |
| F179 | 74179               | 43                            | 50     |
| F180 | 74180               | 29                            | 33     |
| F181 | 74LS181             | 91                            | 117    |
| F182 | 74182               | 28                            | 39     |
| F183 | 74LS183             | 22                            | 26     |
| F190 | 74LS190             | 71                            | 85     |
| F191 | 74LS191             | 68                            | 82     |
| F192 | 74LS192             | 62                            | 74     |
| F193 | 74LS193             | 58                            | 74     |
| F194 | 74LS194A            | 47                            | 50     |
| F195 | 74LS195A            | 35                            | 42     |
| F198 | 74198               | 91                            | 96     |
| F199 | 74199               | 75                            | 81     |
| F260 | 74S260              | 14                            | 12     |
| F261 | 74LS261             | 53                            | 67     |
| F273 | 74LS273             | 54                            | 58     |
| F278 | 74278               | 31                            | 35     |
| F279 | 74LS279             | 8                             | 8      |
| F280 | 74LS280             | 32                            | 51     |
| F283 | 74LS283             | 60                            | 61     |
| F290 | 74LS290             | 32                            | 38     |
| F293 | 74LS293             | 27                            | 32     |
| F298 | 74LS298             | 34                            | 36     |
| F352 | 74LS352             | 22                            | 32     |
| F375 | 74LS375             | 18                            | 18     |
| F377 | 74LS377             | 69                            | 60     |
| F378 | 74LS378             | 53                            | 46     |
| F379 | 74LS379             | 33                            | 32     |
| F381 | 74LS381             | 102                           | 144    |
| F382 | 74LS382             | 106                           | 152    |
| F386 | 74LS386             | 16                            | 16     |
| F390 | 74LS390             | 64                            | 64     |
| F393 | 74LS393             | 52                            | 52     |
| F396 | 74LS396             | 67                            | 72     |
| F398 | 74LS398             | 33                            | 37     |
| F399 | 74LS399             | 33                            | 37     |