

T-71-11-07



GigaBit Logic

16G072

## Transimpedance Amplifier

### 30 dB Gain / 600 MHz Bandwidth

#### FEATURES

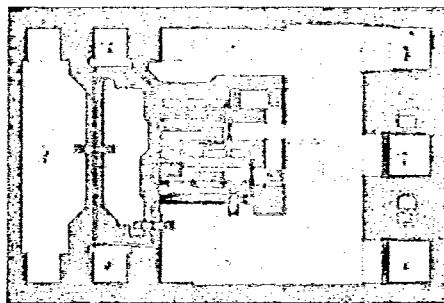
- High gain: 30 dB
- Broad Bandwidth: DC to 600 MHz typ.
- -32 dBm input sensitivity @ 622 Mbit/s &  $10^{-9}$  BER
- Available in die form or die on substrate
- Low output impedance
- Stable operation
- Three choices of integrated feedback resistance: 10, 20, and 30 K $\Omega$

#### APPLICATIONS

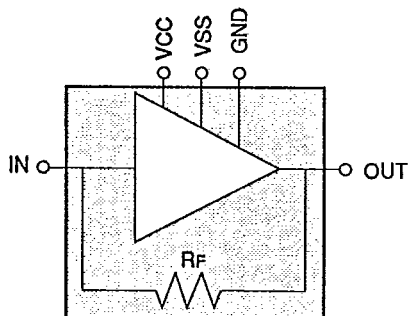
- Fiber optic systems
- Instrumentation and measurement systems

#### FUNCTIONAL DESCRIPTION

The 16G072 is a stable GaAs IC transimpedance amplifier capable of 30 dB gain ( $R_s = R_L = 50\Omega$ ) at a 600 MHz -3 dB cutoff frequency (typ.) making it ideally suited for high speed fiber optic, instrumentation, and measurement applications. It operates from +5V and -3V power supplies. The integrated feedback loop design provides high gain and stable operation. Three choices of integrated feedback resistance are available to match various photodiode load requirements: 10, 20, and 30 K $\Omega$ .



#### CIRCUIT DIAGRAM



#### ELECTRICAL CHARACTERISTICS

0°C to 70°C

|                              |                                                                                             |
|------------------------------|---------------------------------------------------------------------------------------------|
| Feedback Resistance $R_F$    | 10 K $\Omega$ (Typ.)<br>20 K $\Omega$ (Typ.)<br>30 K $\Omega$ (Typ.)                        |
| Gain                         | 29.5 dB ( $R_F = 10K\Omega$ )<br>30 dB ( $R_F = 20K\Omega$ )<br>30 dB ( $R_F = 30K\Omega$ ) |
| High Frequency Cutoff (-3dB) | 600 MHz (Typ.)                                                                              |
| Supply Voltages              | VCC = +5V<br>VSS = -3V                                                                      |
| Supply Currents              | ICC = 35 mA (Typ.)<br>ISS = -25 mA (Typ.)                                                   |

#### ORDERING INFORMATION

| Nominal Feedback Resistance | Die        | Die on Ceramic Substrate |
|-----------------------------|------------|--------------------------|
| 10 K $\Omega$               | 16G072-10X | 16G072-10X1              |
| 20 K $\Omega$               | 16G072-20X | 16G072-20X1              |
| 30 K $\Omega$               | 16G072-30X | 16G072-30X1              |

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| ABSOLUTE MAXIMUM RATINGS                                  |                                                                  |                              |                          |       |                |     |            |
|-----------------------------------------------------------|------------------------------------------------------------------|------------------------------|--------------------------|-------|----------------|-----|------------|
| SYMBOL                                                    | PARAMETER                                                        |                              | ABSOLUTE MAXIMUM RATINGS |       |                |     |            |
| I IN                                                      | Current into any input; continuous                               |                              | 1 mA                     |       |                |     |            |
| I OUT                                                     | Current from any output; continuous                              |                              | 15 mA                    |       |                |     |            |
| V IN                                                      | Voltage applied to any input; continuous<br>VCC = +5V, VSS = -3V |                              | -2 to +0.6V              |       |                |     |            |
| VOUT                                                      | Output Voltage                                                   |                              | -2 to +0.6V              |       |                |     |            |
| VCC                                                       | Supply Voltage                                                   |                              | 0V to +8V                |       |                |     |            |
| VSS                                                       | Supply Voltage                                                   |                              | 0V to -5V                |       |                |     |            |
| PD                                                        | Power Dissipation                                                |                              | 1W                       |       |                |     |            |
| TSTOR                                                     | Storage Temperature                                              |                              | -55 to +150°C            |       |                |     |            |
| TA                                                        | Ambient Operating Temperature                                    |                              | -55 to +125°C            |       |                |     |            |
| RECOMMENDED OPERATING CONDITIONS                          |                                                                  |                              |                          |       |                |     |            |
| PARAMETER                                                 | SYMBOL                                                           | Min                          | Nom                      | Max   | UNITS          |     |            |
| Supply Voltage                                            | VCC                                                              | +4.25                        | +5                       | +6    | V              |     |            |
|                                                           | VSS                                                              | -4                           | -3                       | -2.5  | V              |     |            |
| Output Termination Load Resistance                        | Rload                                                            |                              | 50                       |       | Ω              |     |            |
| Ambient Operating Temperature                             | TA                                                               | 0                            |                          | 70    | °C             |     |            |
| ELECTRICAL CHARACTERISTICS                                |                                                                  |                              |                          |       |                |     |            |
| VCC = +4.25V to +6V, VSS = -4V to -2.5V, TA = 0°C to 70°C |                                                                  |                              |                          |       |                |     |            |
| PARAMETER                                                 | SYMBOL                                                           | TEST CONDITIONS              | PART #                   | VALUE |                |     | UNITS      |
|                                                           |                                                                  |                              |                          | Min   | Typ            | Max |            |
| Supply Current                                            | ICC                                                              | I IN = 0                     | All parts                |       | 35             | 50  | mA         |
|                                                           | ISS                                                              | I IN = 0                     | All parts                |       | -25            | -35 | mA         |
| Feedback Resistance                                       | RF                                                               | DC                           | 16G072-10                | 9     | 10             | 11  | KΩ         |
|                                                           |                                                                  |                              | 16G072-20                | 18    | 20             | 22  | KΩ         |
|                                                           |                                                                  |                              | 16G072-30                | 27    | 30             | 33  | KΩ         |
| Gain<br>(f = 10 MHz)                                      | A                                                                | RS = RL = 50Ω                | 16G072-10                | 29.5  |                |     | dB         |
|                                                           |                                                                  |                              | 16G072-20                | 30.0  |                |     | dB         |
|                                                           |                                                                  |                              | 16G072-30                | 30.0  |                |     | dB         |
| High Frequency Cut-off (-3dB)                             | fc                                                               |                              |                          | 500   | 600            |     | MHz        |
| Sensitivity                                               | @10 <sup>-9</sup><br>@10 <sup>-11</sup>                          | 622 Mbit/s<br>PIN photodiode | 16G072-10                |       | -32.0<br>-31.1 |     | dBm<br>dBm |
| Overload Point @ 10 <sup>-9</sup>                         |                                                                  | PIN photodiode               | 16G072-10                |       | -13.6          |     | dBm        |

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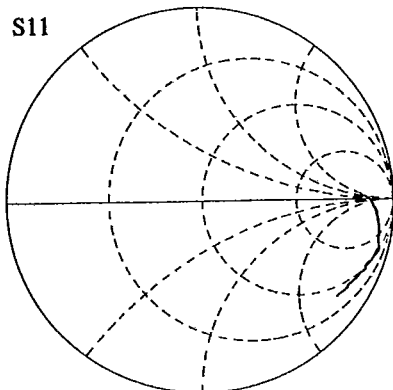
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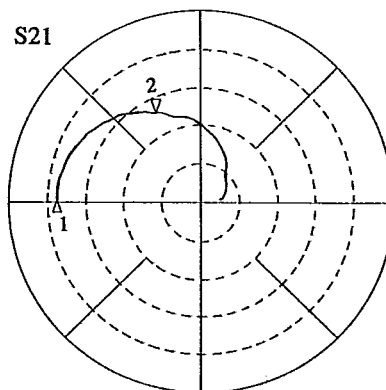
# EXAMPLES OF AC CHARACTERISTICS

## 1) S-Parameters

1 Unit Full Scale

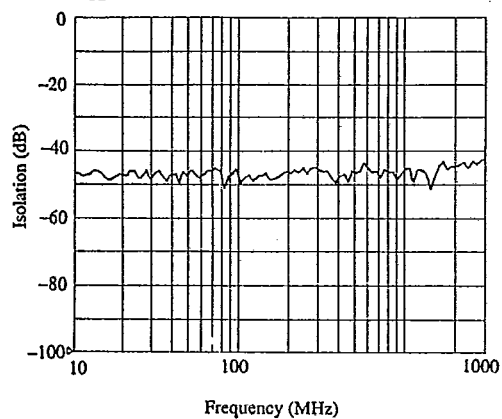


50 Units Full Scale

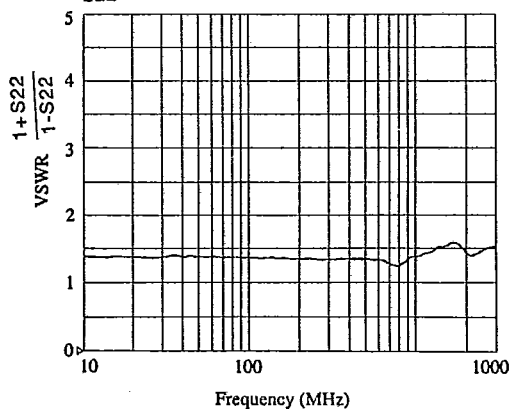


Markers 1: 10MHz  
2: 600MHz

S12



S22



Conditions: VCC = +5V, VSS = -3V, RF = 9.5 KΩ

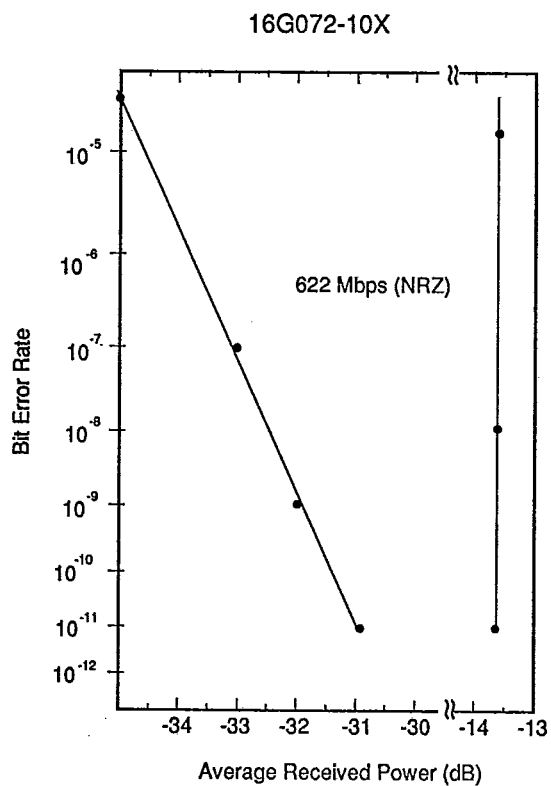
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# SENSITIVITY CHARACTERISTICS



- RF = 10K $\Omega$
- Fujitsu FID13S51SR pin photodiode
- 1.3  $\mu$ m wavelength
- $2^{15}-1$  PRBS, Mark Ratio = 1/2

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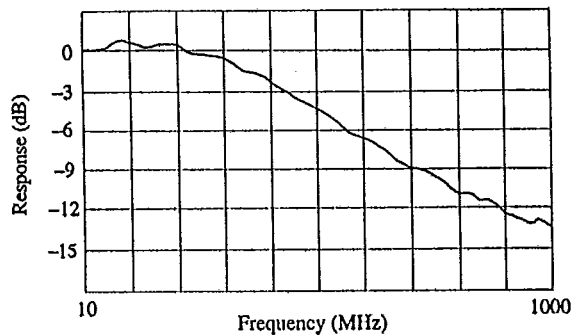


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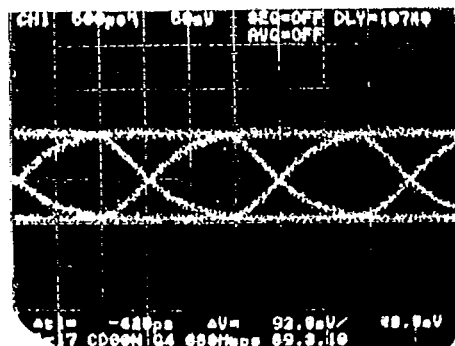
EXAMPLE OF PIN-AMP SYSTEM MEASUREMENT

1) Frequency Response

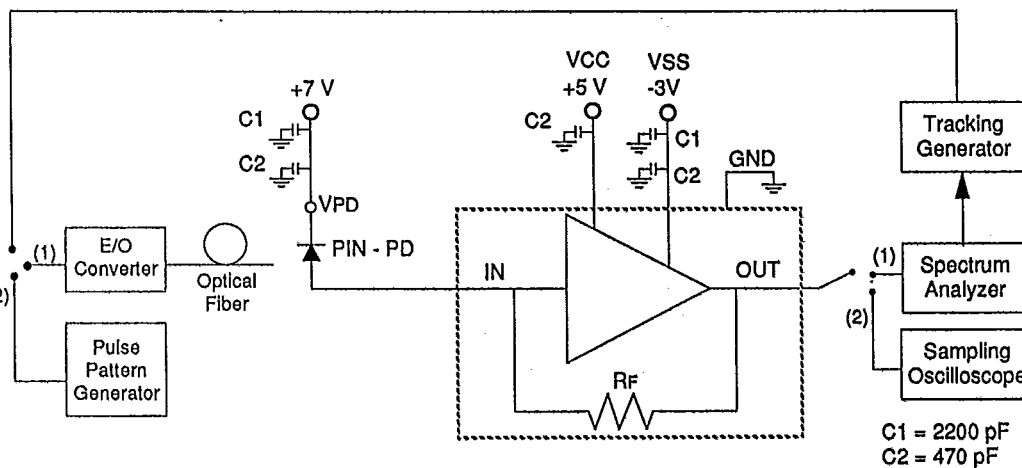


Conditions:  
VCC = +5V  
VSS = -3V  
VPD = +7V  
RF = 9.6 K $\Omega$   
FL = 50 $\Omega$

2) Eye Diagram



Pin=-22dBm  
680Mbps (NRZ)



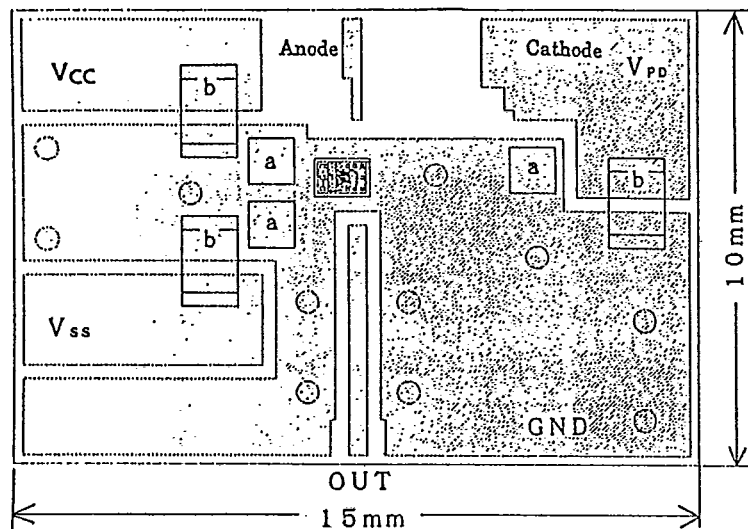


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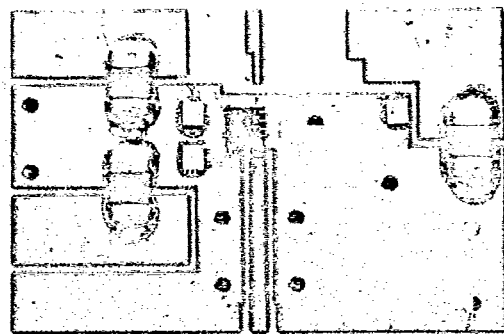
16G072

DIE ON SUBSTRATE LAYOUT (16G072-X1)



$a = 470 \text{ pF}$   
 $b = 2200 \text{ pF}$   
 $VCC = +5V \text{ Supply Voltage}$   
 $VSS = -3V \text{ Supply Voltage}$   
 $VPD = \text{Detector Bias Voltage}$   
 $OUT = \text{Output}$   
 $\text{Thickness} = 635 \mu\text{m}$

DIE ON SUBSTRATE PHOTOGRAPH



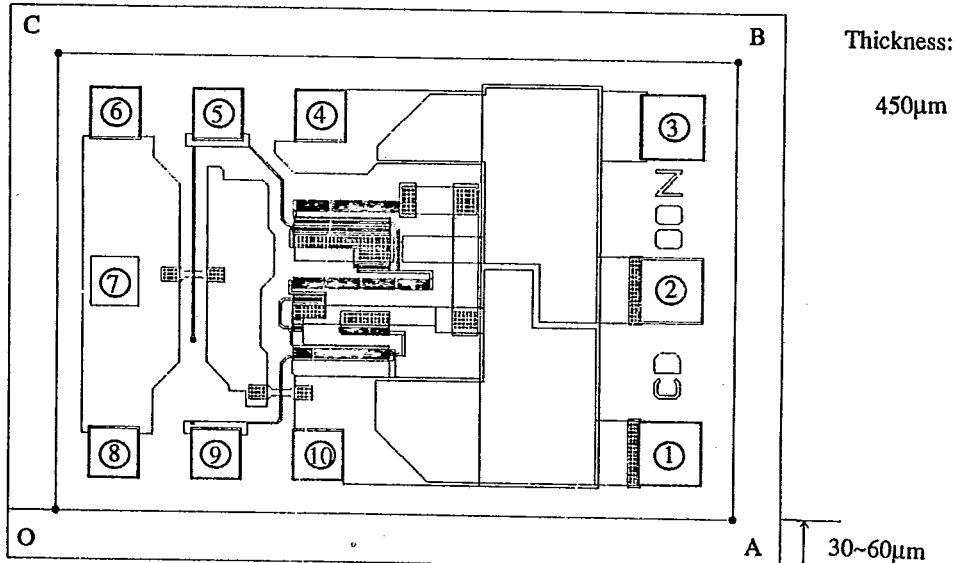
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## DIE PAD ASSIGNMENTS



| PAD       | PAD SIZE  | CENTER POSITION (µm) | PAD        | PAD SIZE  | CENTER POSITION (µm) |
|-----------|-----------|----------------------|------------|-----------|----------------------|
| 1 ... VCC | 95 µm sq. | 960, 100             | 8 ... GND  | 75 µm sq. | 90, 90               |
| 2 ... VSS | 95 µm sq. | 960, 350             | 9 ... IN   | 75 µm sq. | 250, 90              |
| 3 ... GND | 95 µm sq. | 960, 600             | 10 ... GND | 75 µm sq. | 410, 90              |
| 4 ... GND | 75 µm sq. | 410, 610             | A          |           | 1060, 0              |
| 5 ... OUT | 75 µm sq. | 250, 610             | B          |           | 1060, 700            |
| 6 ... GND | 75 µm sq. | 90, 610              | C          |           | 0, 700               |
| 7 ... GND | 75 µm sq. | 90, 354              | O          |           | 0, 0                 |

## PRECAUTIONS

Because of their small dimensions, the GaAs FETs from which the 16G072 is designed can be damaged or destroyed when subjected to large transient voltages. Such transients can be generated by power supplies when switched on if not properly decoupled. It is also possible to induce spikes from static electricity charged operators or ungrounded equipment. To prevent damage to devices from transient breakdown.

- DC ground all equipment and operators
- Avoid any voltages surges when turning on power supplies

T-90-20

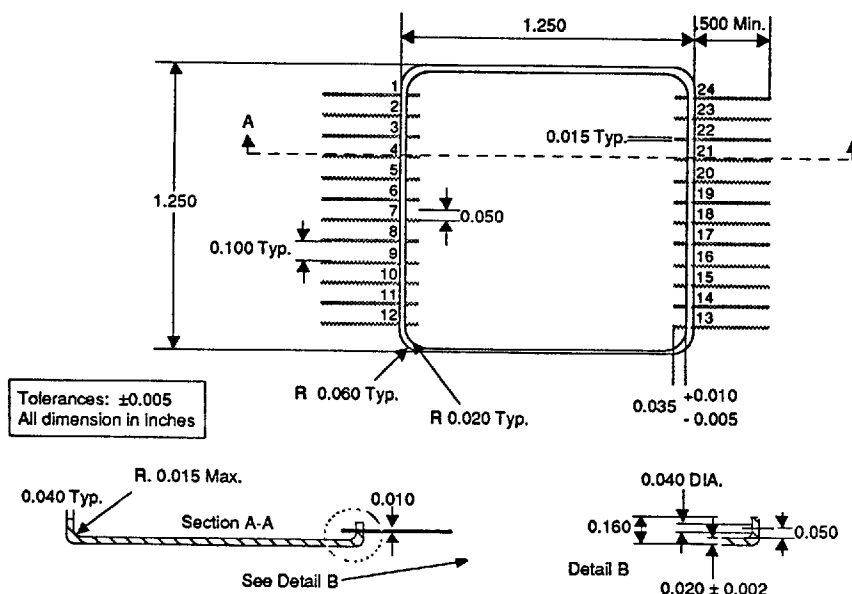


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# 24 PIN METAL FLATPACK 18 PIN PACKAGE

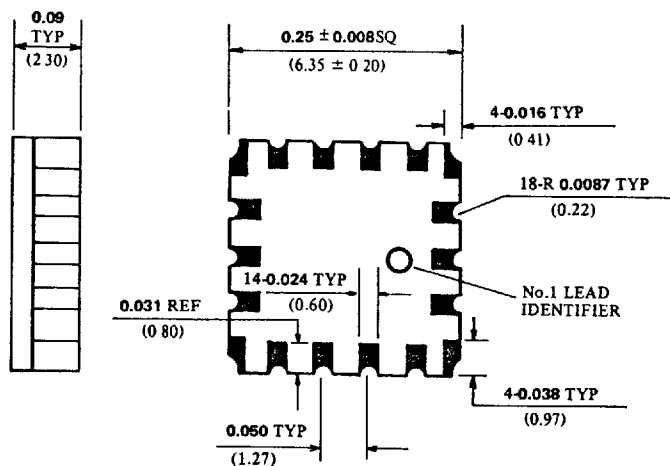
## 24 PIN METAL FLATPACK

Type H



## 18 PIN LEADLESS CHIP CARRIER

TYPE L1



All dimensions shown in inches and (millimeters)

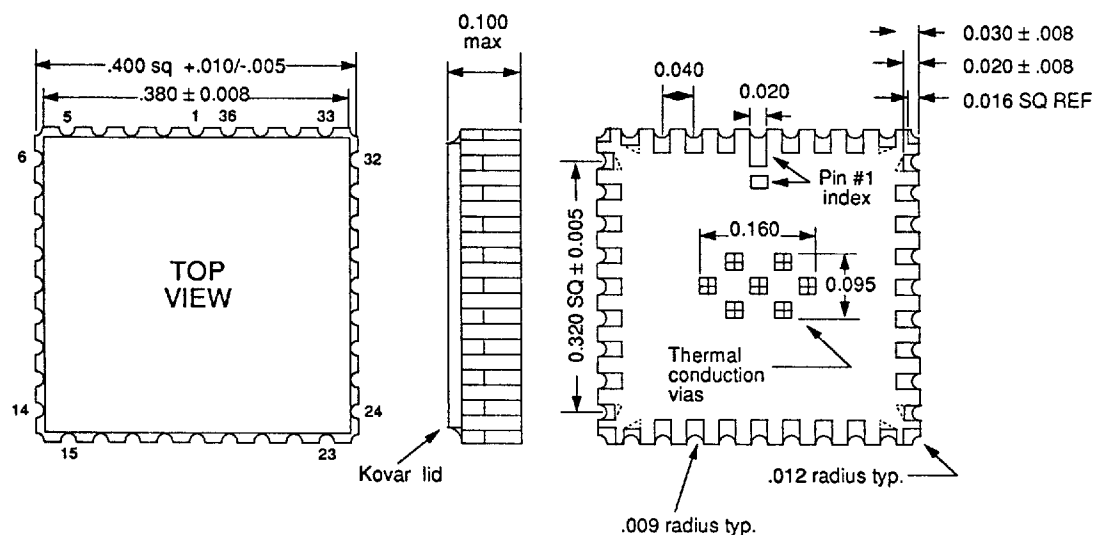
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36 PIN PACKAGES

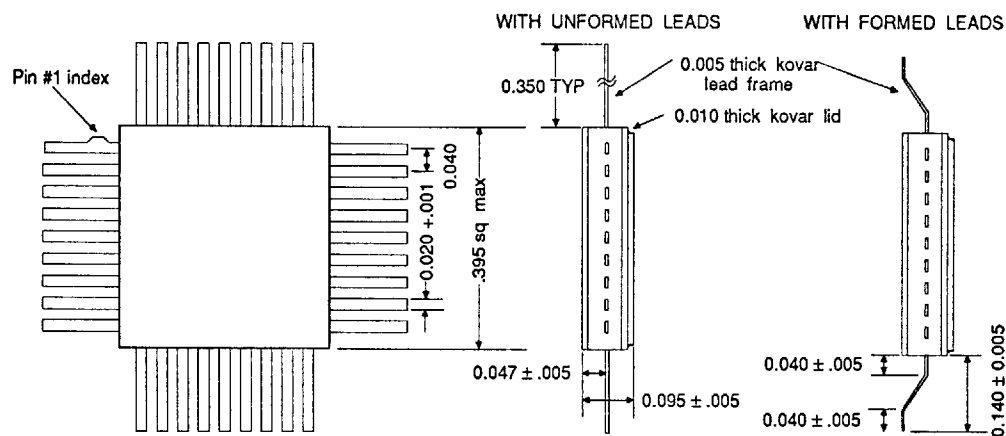
### 36 PIN LEADLESS CHIP CARRIER TYPE L36



#### NOTES:

- 1) The package bottom thermal vias, top lid surface and 4 metallized corner castellations (when present) are all at Vss potential.
- 2) All dimensions in inches.
- 3) Pin #1 identifier may be an elongated pad or small, square gray marker.

### 36 I/O LEAD FLATPACK TYPE F

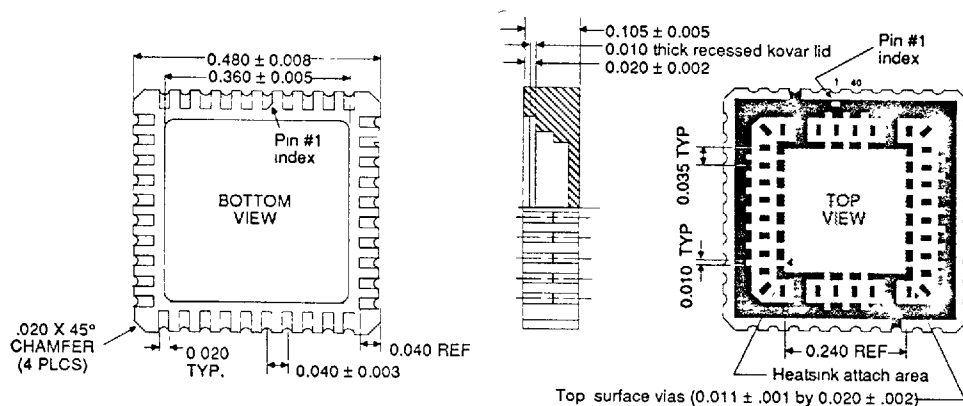




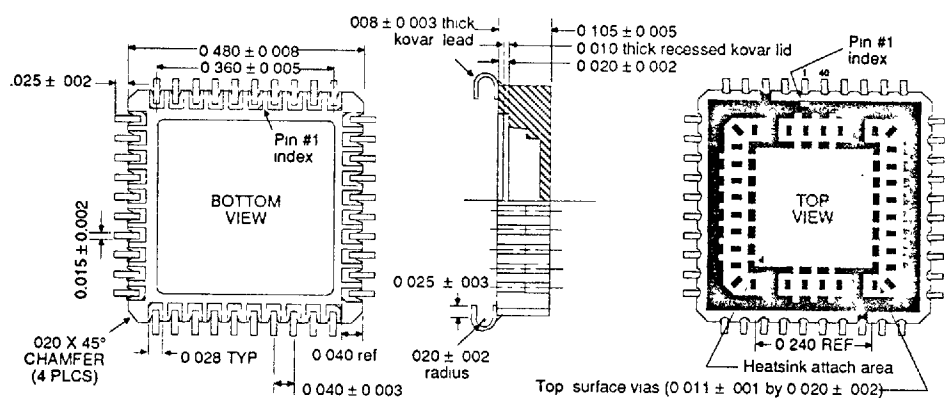
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T-90-20  
40 PIN PACKAGES

### 40 PIN LEADLESS CHIP CARRIER TYPE L



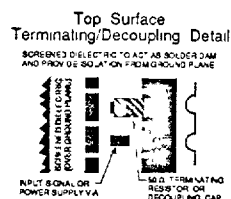
### 40 PIN LEADED CHIP CARRIER TYPE C



#### NOTES

- (1) Footprint is JEDEC standard outline
- (2) Top surface vias (for terminating resistors and decoupling capacitors) are not available on pins 3, 4, 17, 18, 23, 24, 37, and 38
- (3) Top surface metal (not including vias) and pins 3 and 23 are fixed at VTT potential
- (4) Recommended top surface chip resistors are  $0.040$  long by  $0.020$  wide by  $0.010$  thick typ. 100 mw min. nominal power rating (Mini-Systems MSR 21 or equivalent)
- (5) Recommended top surface chip capacitors are  $0.040$  long by  $0.030$  wide by  $0.020$  thick typ. 25V VCCW 1000 pf min. (Johnson R09, case or equivalent)
- (6) Recommended heat/sinks are GBL P/Ns 90GHS 40 A and 90GHS 40 B
- (7) Thermally conductive, electrically non-conductive epoxy is recommended for heatsink attachment (Ablestick 789 4 or 561K, or Thermalloy Thermalbond™ or equivalent)
- (8) L40 and C40 packages are dimensionally identical except for contact finger width

| TOP SURFACE LEGEND  |  |
|---------------------|--|
| Metalized Ceramic   |  |
| Screened Dielectric |  |
| Bare Ceramic        |  |



*T-90-20*  
68 & 132 PIN  
PACKAGES

Figure 1: Mechanical drawing of the bottom view, top view, and cross-section of the package. The bottom view shows a square package with a 0.640 inch width and 0.610 inch height. The top view shows a square package with a 0.750 inch square footprint. The cross-section shows the package height of 0.060 inch (C1B) and 0.050 inch (C1A).

- ## GULLWING LEADS

