

# FCT FAMILY GENERAL CHARACTERISTICS

## DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

$T_A = 0^\circ\text{C}$  to  $+70^\circ\text{C}$   $V_{CC} = 5.0\text{V} \pm 5\%$  Min = 4.75V Max = 5.25V (Commercial)

$T_A = -55^\circ\text{C}$  to  $+125^\circ\text{C}$   $V_{CC} = 5.0\text{V} \pm 10\%$  Min = 4.50V Max = 5.50V (Military),  $V_{LC} = 0.2\text{V}$   $V_{HC} = V_{CC} - 0.2\text{V}$

| SYMBOL     | PARAMETER                     | TEST CONDITIONS <sup>1</sup>                                                     | MIN                     | TYP <sup>2</sup> | MAX            | UNIT          |
|------------|-------------------------------|----------------------------------------------------------------------------------|-------------------------|------------------|----------------|---------------|
| $V_{IH}$   | Input HIGH Level              | Guaranteed Logic High Level                                                      | 2.0                     | —                | —              | V             |
| $V_{IL}$   | Input LOW Level               | Guaranteed Logic Low Level                                                       | —                       | —                | 0.8            | V             |
| $I_{IH}$   | Input HIGH Current            | $V_{CC} = \text{Max}$ , $V_{IN} = V_{CC}$                                        | —                       | —                | 5              | $\mu\text{A}$ |
| $I_{IL}$   | Input LOW Current             | $V_{CC} = \text{Max}$ , $V_{IN} = \text{GND}$                                    | —                       | —                | -5             | $\mu\text{A}$ |
| $I_{OS}$   | Short Circuit Current         | $V_{CC} = \text{Max}$ <sup>3</sup>                                               | -60                     | -120             | —              | mA            |
| $V_H$      | Hysteresis                    | Inputs                                                                           | —                       | 0.4              | —              | V             |
| $V_{IK}$   | Input Clamp Voltage           | $V_{CC} = \text{Min}$                                                            | $I_{IN} = -18\text{mA}$ |                  | -1.2           | V             |
|            |                               |                                                                                  | $I_{IN} = 18\text{mA}$  |                  | $V_{CC} + 1.2$ | V             |
| $I_{OZ}$   | High Impedance Output Current | $V_{CC} = \text{Max}$<br>$V_O = V_{CC}$ or Gnd                                   | Output Only             |                  | $\pm 10$       | $\mu\text{A}$ |
|            |                               |                                                                                  | Bidirectional           |                  | $\pm 15$       | $\mu\text{A}$ |
| $V_{OH}$   | Output HIGH Voltage           | $V_{CC} = 3\text{V}$ , $V_{IN} = V_{LC}$ or $V_{HC}$ , $I_{OH} = 32\mu\text{A}$  | $V_{HC}$                | $V_{CC}$         | —              | V             |
|            |                               | $V_{CC} = \text{Min}$ , $I_{OH} = -300\mu\text{A}$                               | $V_{HC}$                | $V_{CC}$         | —              |               |
|            |                               | $V_{IN} = V_{IH}$ or $V_{IL}$ , $I_{OH} = -12\text{mA Mil}$ <sup>5</sup>         | 2.4                     | 4.3              | —              |               |
|            |                               | $I_{OH} = -15\text{mA Comm}$ <sup>5</sup>                                        | 2.4                     | 4.3              | —              |               |
| $V_{OL}$   | Output LOW Voltage            | $V_{CC} = 3\text{V}$ , $V_{IN} = V_{LC}$ or $V_{HC}$ , $I_{OL} = 300\mu\text{A}$ | —                       | GND              | $V_{LC}$       | V             |
|            |                               | $V_{CC} = \text{Min}$ , $I_{OL} = 300\mu\text{A}$                                | —                       | GND              | $V_{LC}$       |               |
|            |                               | $V_{IN} = V_{IH}$ or $V_{IL}$ , $I_{OL} = 32\text{mA Mil}$                       | —                       | 0.3              | 0.5            |               |
|            |                               | $I_{OL} = 48\text{mA Comm}$                                                      | —                       | 0.3              | 0.5            |               |
| $V_{OH}^4$ | Output HIGH Voltage           | $V_{CC} = 3\text{V}$ , $V_{IN} = V_{LC}$ or $V_{HC}$ , $I_{OH} = 32\mu\text{A}$  | $V_{HC}$                | $V_{CC}$         | —              | V             |
|            |                               | $V_{CC} = \text{Min}$ , $I_{OH} = -300\mu\text{A}$                               | $V_{HC}$                | $V_{CC}$         | —              |               |
|            |                               | $V_{IN} = V_{IH}$ or $V_{IL}$ , $I_{OH} = -12\text{mA Mil}$ <sup>5</sup>         | 2.4                     | 4.3              | —              |               |
|            |                               | $I_{OH} = -15\text{mA Comm}$ <sup>5</sup>                                        | 2.4                     | 4.3              | —              |               |
| $V_{OL}^4$ | Output LOW Voltage            | $V_{CC} = 3\text{V}$ , $V_{IN} = V_{LC}$ or $V_{HC}$ , $I_{OL} = 300\mu\text{A}$ | —                       | GND              | $V_{LC}$       | V             |
|            |                               | $V_{CC} = \text{Min}$ , $I_{OL} = 300\mu\text{A}$                                | —                       | GND              | $V_{LC}$       |               |
|            |                               | $V_{IN} = V_{IH}$ or $V_{IL}$ , $I_{OL} = 48\text{mA Mil}$                       | —                       | 0.3              | 0.55           |               |
|            |                               | $I_{OL} = 64\text{mA Comm}$                                                      | —                       | 0.3              | 0.55           |               |

### Notes:

1. For conditions shown as max. or min., use appropriate value specified under Electrical Characteristics for the applicable device type.

2. Typical values are at  $V_{CC} = 5.0\text{V}$ ,  $+25^\circ\text{C}$  ambient and maximum loading.

3. Not more than one output should be shorted at one time. Duration of the short circuit test should not exceed one second.

4. FCT240, FCT244, FCT245, FCT640, FCT645 only.

5.  $I_{OH} = -24\text{mA}$  also available.

# FCT FAMILY GENERAL CHARACTERISTICS

## ABSOLUTE MAXIMUM RATING<sup>1</sup>

| SYMBOL            | RATING                               | COMMERCIAL   | MILITARY     | UNIT |
|-------------------|--------------------------------------|--------------|--------------|------|
| V <sub>TERM</sub> | Terminal Voltage with Respect to GND | -0.5 to +7.0 | -0.5 to +7.0 | V    |
| T <sub>A</sub>    | Operating Temperature                | 0 to +70     | -55 to +125  | °C   |
| T <sub>BIAS</sub> | Temperature Under Bias               | -55 to +125  | -65 to +135  | °C   |
| T <sub>STG</sub>  | Storage Temperature                  | -55 to +125  | -65 to +150  | °C   |
| I <sub>OUT</sub>  | DC Output Current                    | 120          | 120          | mA   |

Note 1: Maximum ratings are those values beyond which damage to the device may occur.

## RECOMMENDED OPERATING CONDITIONS

| SYMBOL                          | PARAMETER                 | Min |      | Typ |      | Max                  |      | UNIT |
|---------------------------------|---------------------------|-----|------|-----|------|----------------------|------|------|
|                                 |                           | Mil | Comm | Mil | Comm | Mil                  | Comm |      |
| V <sub>CC</sub>                 | Supply Voltage            | 4.5 | 4.75 | 5.0 | 5.0  | 5.5                  | 5.25 | V    |
| T <sub>A</sub>                  | Operating Free-Air Temp   | -55 | 0    |     |      | 125                  | 70   | °C   |
| t <sub>r</sub> , t <sub>f</sub> | Input, Rise and Fall Time |     |      | 3   | 3    |                      |      | ns   |
| V <sub>IH</sub>                 | High Level Input Voltage  | 2.0 | 2.0  |     |      | V <sub>CC</sub> +0.5 |      | V    |
| V <sub>IL</sub>                 | Low Level Input Voltage   | 0.5 | -0.5 |     |      | 0.8                  | 0.8  | V    |

## POWER SUPPLY CHARACTERISTICS

| V <sub>LC</sub> = 0.2V; V <sub>HC</sub> = V <sub>CC</sub> - 0.2V |                                                   |                                                                                                                                        |                                                                        |                    |      |                    |
|------------------------------------------------------------------|---------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|--------------------|------|--------------------|
| SYMBOL                                                           | PARAMETER                                         | TEST CONDITIONS <sup>(1)</sup>                                                                                                         | MIN                                                                    | TYP <sup>(2)</sup> | MAX  | UNIT               |
| I <sub>CCQ</sub>                                                 | Quiescent Power Supply Current                    | V <sub>CC</sub> = Max.<br>V <sub>IN</sub> ≥ V <sub>HC</sub> ; V <sub>IN</sub> ≤ V <sub>LC</sub> ; f <sub>CP</sub> = f <sub>i</sub> = 0 | —                                                                      | 0.001              | 1.5  | mA                 |
| I <sub>CCT</sub>                                                 | Quiescent Power Supply Current<br>TTL Inputs HIGH | V <sub>CC</sub> = Max. <sup>(3)</sup><br>V <sub>IN</sub> = 3.4V                                                                        | —                                                                      | 0.5                | 1.6  | mA                 |
| I <sub>CCD</sub>                                                 | Dynamic Power Supply Current                      | V <sub>CC</sub> = Max., Outputs Open, $\overline{OE}$ = GND<br>One Bit Toggling, 50% Duty Cycle <sup>(5)</sup>                         | V <sub>IN</sub> ≥ V <sub>HC</sub><br>V <sub>IN</sub> ≤ V <sub>LC</sub> | —                  | 0.15 | 0.25<br>mA/<br>MHz |

Notes:

1. For conditions shown as max. or min. use appropriate value specified under Electrical Characteristics for the applicable device type

2. Typical values are at V<sub>CC</sub> = 5.0V, +25°C ambient and maximum loading

3. Per TTL driven input (V<sub>IN</sub> = 3.4V); all other inputs at V<sub>CC</sub> or GND.

4. I<sub>CC</sub> = I<sub>QUIESCENT</sub> + I<sub>INPUTS</sub> + I<sub>DYNAMIC</sub>

I<sub>CC</sub> = I<sub>CCQ</sub> + I<sub>CCT</sub>D<sub>H</sub>NT + I<sub>CCD</sub>(f<sub>CP</sub>/2 + f<sub>i</sub>N<sub>i</sub>)

I<sub>CCQ</sub> = Quiescent Current

I<sub>CCT</sub> = Power supply current for TTL high input (V<sub>IN</sub> = 3.4V)

D<sub>H</sub> = Duty cycle for TTL inputs high

N<sub>T</sub> = Number of TTL inputs at D<sub>H</sub>

I<sub>CCD</sub> = Dynamic current caused by an input transition pair (HLH or LHL)

f<sub>CP</sub> = Clock frequency for register devices (zero for non-register devices)

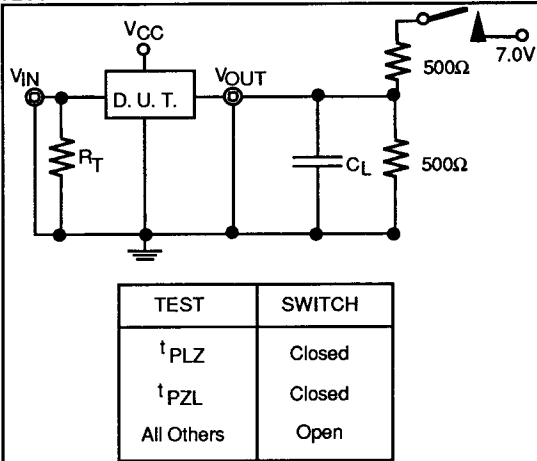
f<sub>i</sub> = Input frequency

N<sub>i</sub> = Number of inputs at f<sub>i</sub>

5. "Catch all" = if CE it is low, to make toggle

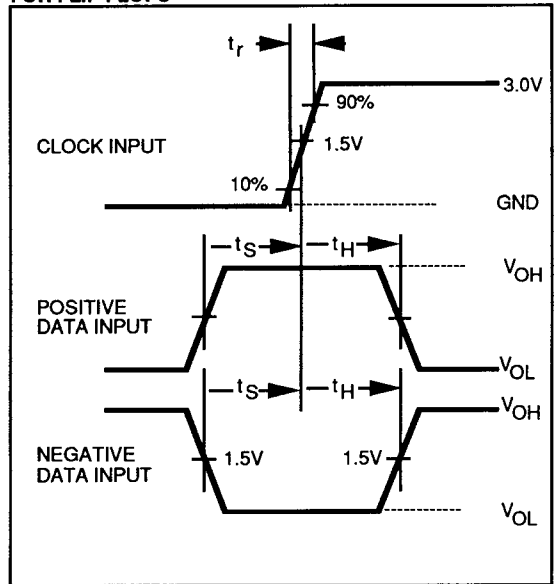
All currents are in milliamps and all frequencies are in megahertz.

### TEST CIRCUIT OUTPUT TESTS

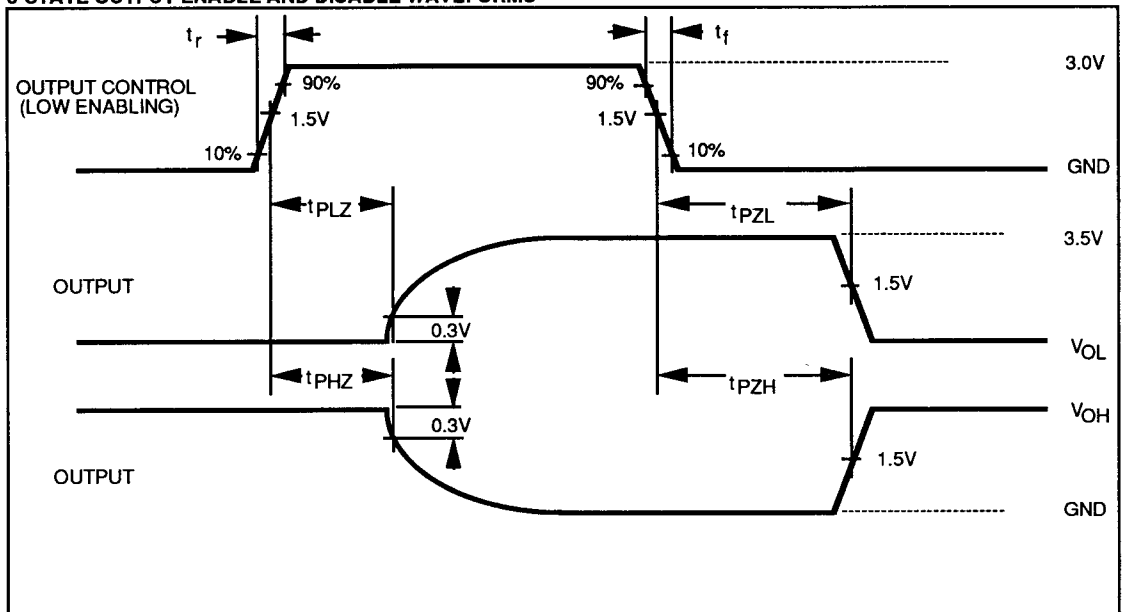


$C_L$  = Load Capacitance includes jig and probe capacitance  
 $R_T$  = Termination should be equal to  $Z_{OUT}$  of pulse generators  
 $V_{IN}$  = 0 to 3V  
 Input =  $t_r = t_f \leq 2.5ns$  (10% to 90%)

### SETUP AND HOLD TIME WAVEFORMS FOR FLIP FLOPS

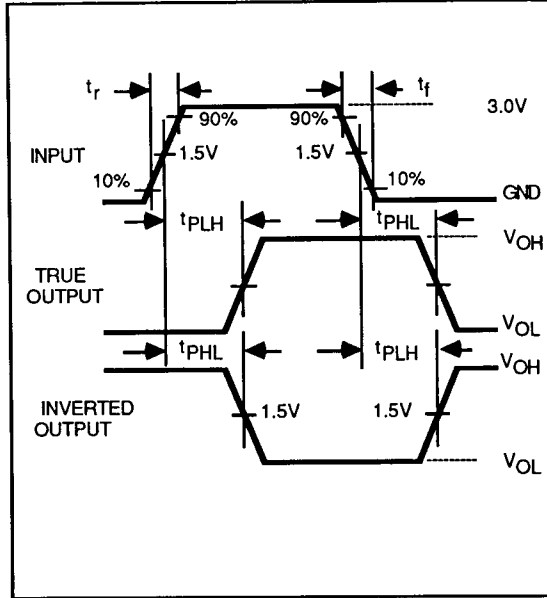


### 3-STATE OUTPUT ENABLE AND DISABLE WAVEFORMS

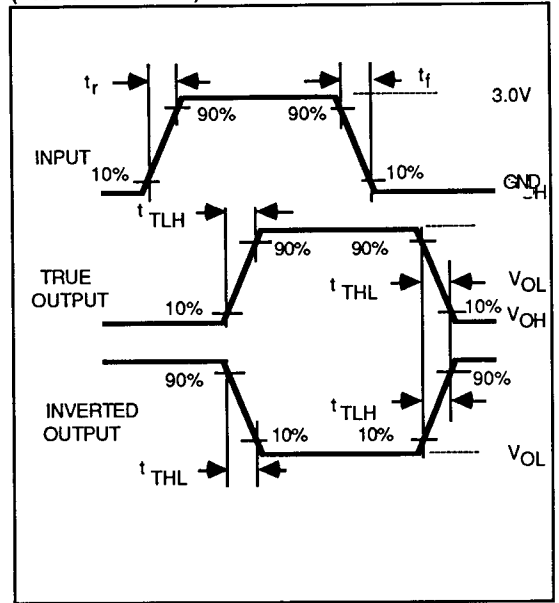


# FCT FAMILY GENERAL CHARACTERISTICS

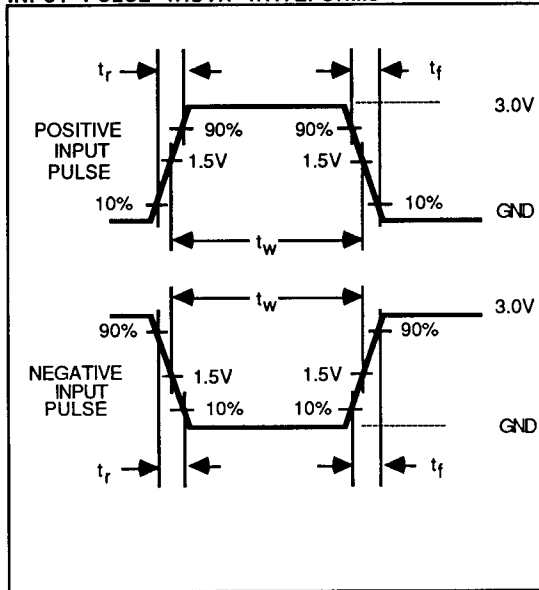
PROPAGATION DELAY WAVEFORMS



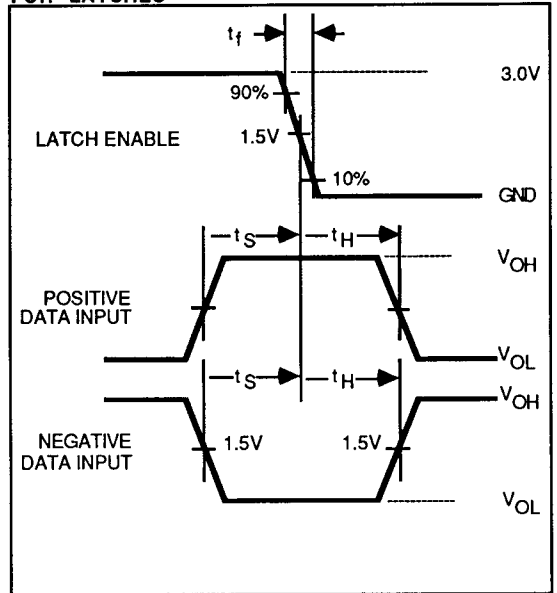
OUTPUT TRANSITION TIME WAVEFORMS  
( 10-90% of 3.0V )



INPUT PULSE WIDTH WAVEFORMS



SETUP AND HOLD TIME WAVEFORMS  
FOR LATCHES



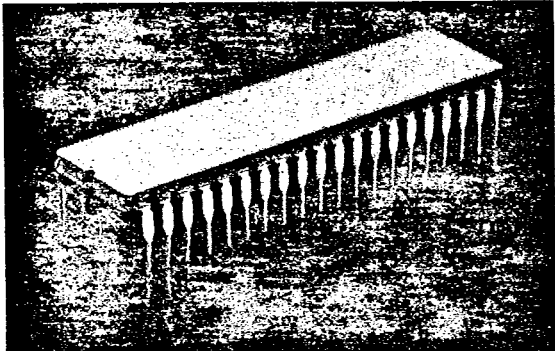
PACKAGING

T-90-20

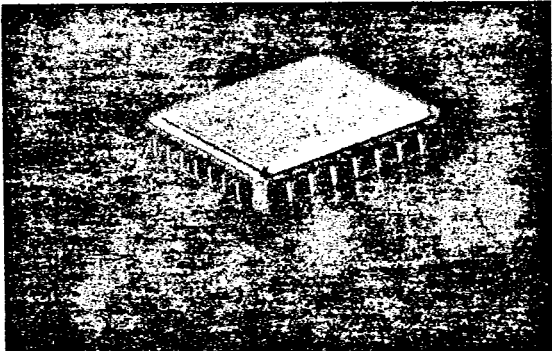
VTC offers a wide variety of industry-standard packages for its products. These include plastic and ceramic dual in-line, side brazed ceramic, plastic small outline, plastic leaded chip carrier, ceramic leadless chip carrier, surface mount plastic, ceramic flatpacks and pin grid array packages.

Pin counts to 172 pins are used in volume manufacturing and pin counts up to 300 are in development.

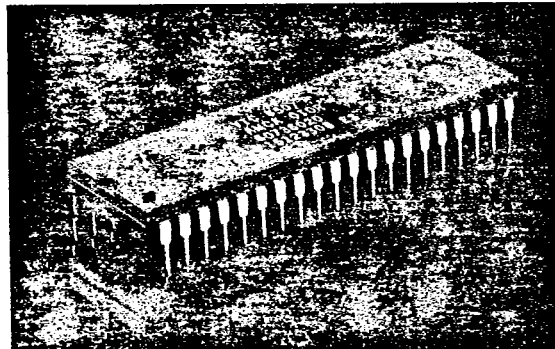
The packages dimensions given in this section are offered for VTC's advanced CMOS logic products. The ACL products are available compliant to MIL-STD-883.



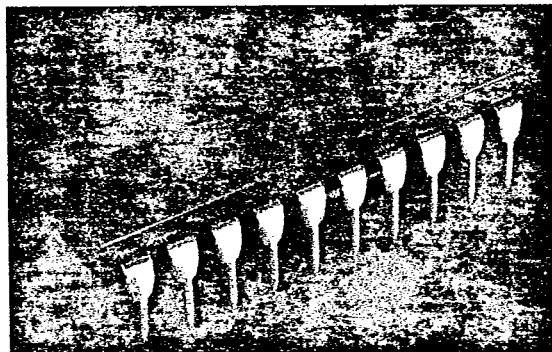
Ceramic DIP (Cerdip)



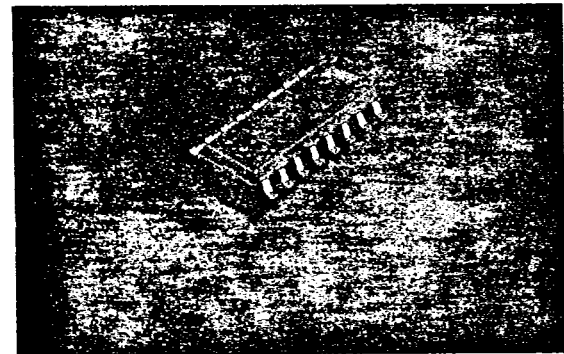
Ceramic Leadless Chip Carrier (LCC)



Plastic DIP



Plastic Slimline DIP



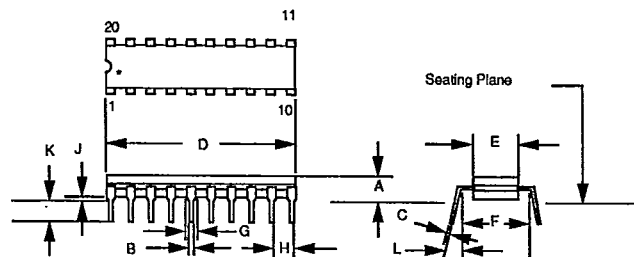
Plastic SOIC

PACKAGING  
AND ORDERING

## CERAMIC DIP (CERDIP)

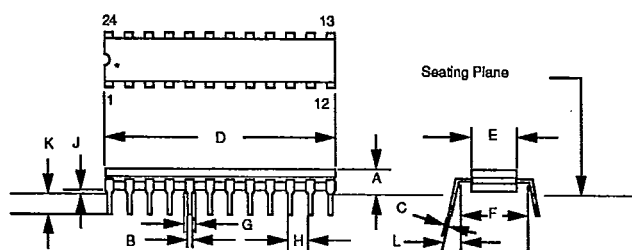
T-90-20

| 20 PIN CERAMIC DIP |           |       |             |       |
|--------------------|-----------|-------|-------------|-------|
| SYMBOL             | INCHES    |       | MILLIMETERS |       |
|                    | MIN.      | MAX.  | MIN.        | MAX.  |
| A                  | 0.155     | 0.200 | 3.94        | 5.08  |
| B                  | 0.014     | 0.023 | 0.36        | 0.58  |
| C                  | 0.008     | 0.015 | 0.20        | 0.38  |
| D                  | 0.940     | 0.960 | 23.87       | 24.39 |
| E                  | 0.220     | 0.300 | 5.59        | 7.62  |
| F                  | 0.300 BSC |       | 7.62 BSC    |       |
| G                  | 0.030     | 0.070 | 0.76        | 1.78  |
| H                  | 0.100 BSC |       | 2.54 BSC    |       |
| J                  | 0.015     | 0.060 | 0.38        | 1.52  |
| K                  | 0.125     | 0.200 | 3.18        | 5.08  |
| L                  | 0°        | 15°   | 0°          | 15°   |



\*Note: Index area; a notch or a lead one identification mark is located adjacent to lead one.

| 24 PIN CERAMIC DIP |           |       |             |       |
|--------------------|-----------|-------|-------------|-------|
| SYMBOL             | INCHES    |       | MILLIMETERS |       |
|                    | MIN.      | MAX.  | MIN.        | MAX.  |
| A                  | 0.155     | 0.200 | 3.94        | 5.08  |
| B                  | 0.014     | 0.023 | 0.36        | 0.58  |
| C                  | 0.008     | 0.015 | 0.20        | 0.38  |
| D                  | 1.150     | 1.350 | 29.21       | 34.29 |
| E                  | 0.220     | 0.300 | 5.59        | 7.62  |
| F                  | 0.300 BSC |       | 7.62 BSC    |       |
| G                  | 0.030     | 0.070 | 0.76        | 1.78  |
| H                  | 0.100 BSC |       | 2.54 BSC    |       |
| J                  | 0.015     | 0.060 | 0.38        | 1.52  |
| K                  | 0.125     | 0.200 | 3.18        | 5.08  |
| L                  | 0°        | 15°   | 0°          | 15°   |

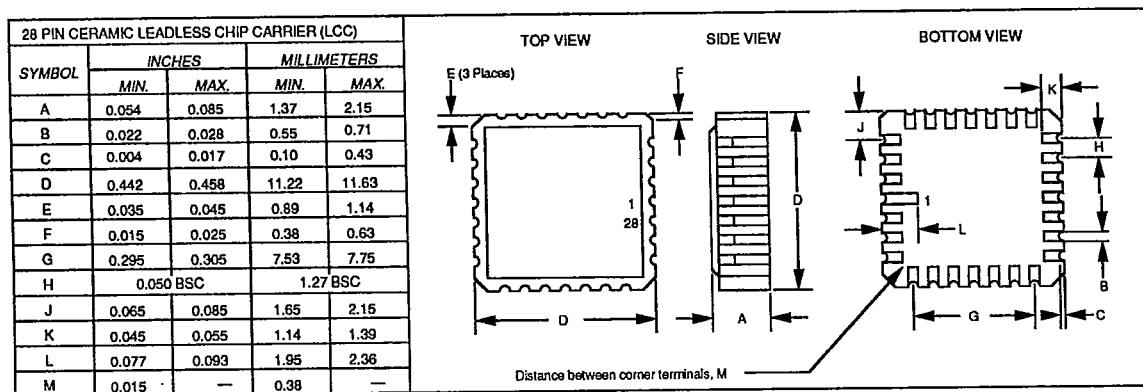
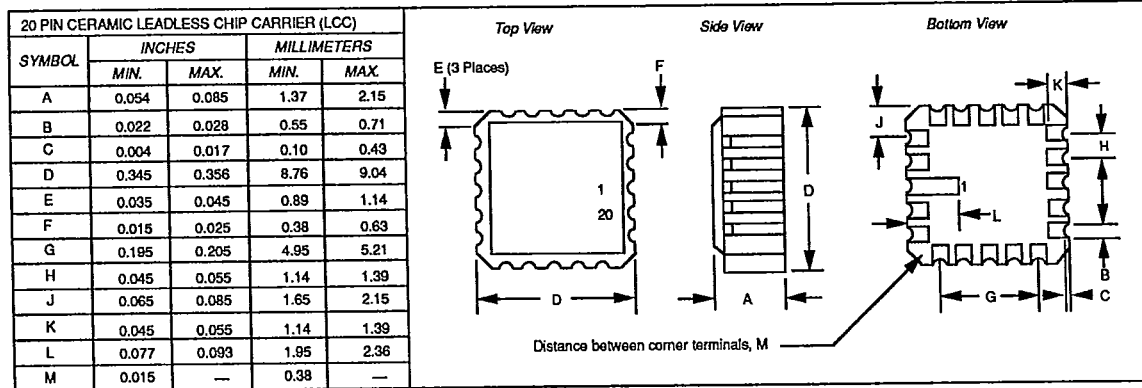


\*Note: Index area; a notch or a lead one identification mark is located adjacent to lead one.

PACKAGING  
AND ORDERING

CERAMIC LEADLESS CHIP CARRIER (LCC)

T-90-20

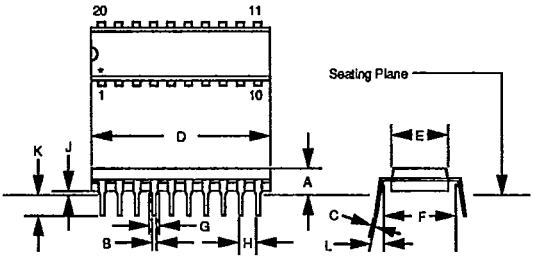


PACKAGING  
AND ORDERING

PLASTIC DIP

T-90 -20

| 20 PIN PLASTIC DIP |           |       |             |       |
|--------------------|-----------|-------|-------------|-------|
| SYMBOL             | INCHES    |       | MILLIMETERS |       |
|                    | MIN.      | MAX.  | MIN.        | MAX.  |
| A                  | —         | 0.210 | —           | 5.33  |
| B                  | 0.014     | 0.022 | 0.356       | 0.558 |
| C                  | 0.008     | 0.015 | 0.204       | 0.381 |
| D                  | 0.925     | 1.060 | 23.5        | 26.9  |
| E                  | 0.240     | 0.280 | 6.10        | 7.11  |
| F                  | 0.300     | 0.325 | 7.62        | 8.25  |
| G                  | 0.045     | 0.070 | 1.15        | 1.77  |
| H                  | 0.100 BSC |       | 2.54 BSC    |       |
| J                  | 0.015     | —     | 0.39        | —     |
| K                  | 0.115     | 0.160 | 2.93        | 4.06  |
| L                  | 0°        | 15°   | 0°          | 15°   |



\*Note: Index area; a notch or a lead one identification mark is located adjacent to lead one.

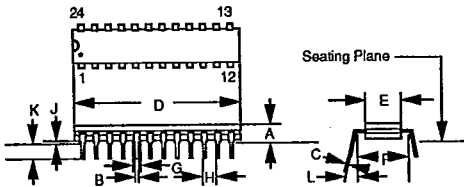
PACKAGING  
AND ORDERING



PLASTIC SLIMLINE DIP

T-90-20

| 24 PIN 'SLIMLINE' PLASTIC DIP |           |       |             |       |
|-------------------------------|-----------|-------|-------------|-------|
| SYMBOL                        | INCHES    |       | MILLIMETERS |       |
|                               | MIN.      | MAX.  | MIN.        | MAX.  |
| A                             | —         | 0.210 | —           | 5.33  |
| B                             | 0.014     | 0.022 | 0.356       | 0.558 |
| C                             | 0.008     | 0.015 | 0.204       | 0.381 |
| D                             | 1.125     | 1.275 | 29.3        | 32.3  |
| E                             | 0.240     | 0.280 | 6.10        | 7.11  |
| F                             | 0.300 BSC |       | 7.62 BSC    |       |
| G                             | 0.045     | 0.070 | 1.15        | 1.77  |
| H                             | 0.100 BSC |       | 2.54 BSC    |       |
| J                             | 0.015     | —     | 0.39        | —     |
| K                             | 0.115     | 0.160 | 2.93        | 4.06  |
| L                             | 0°        | 15°   | 0°          | 15°   |

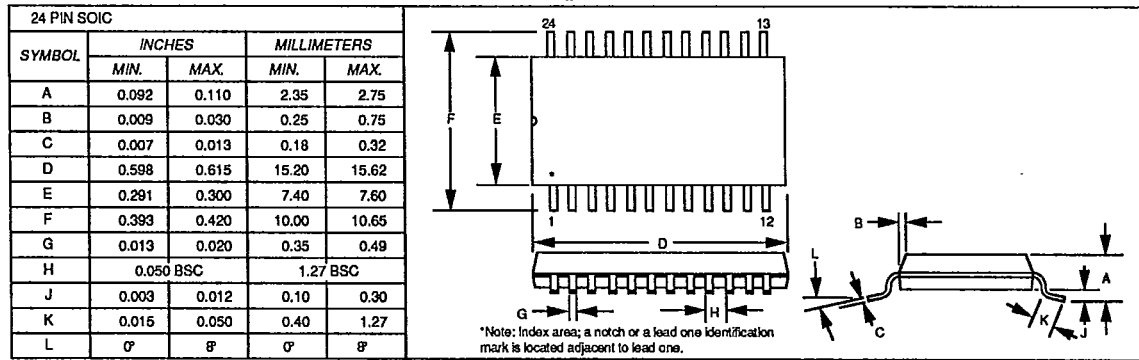
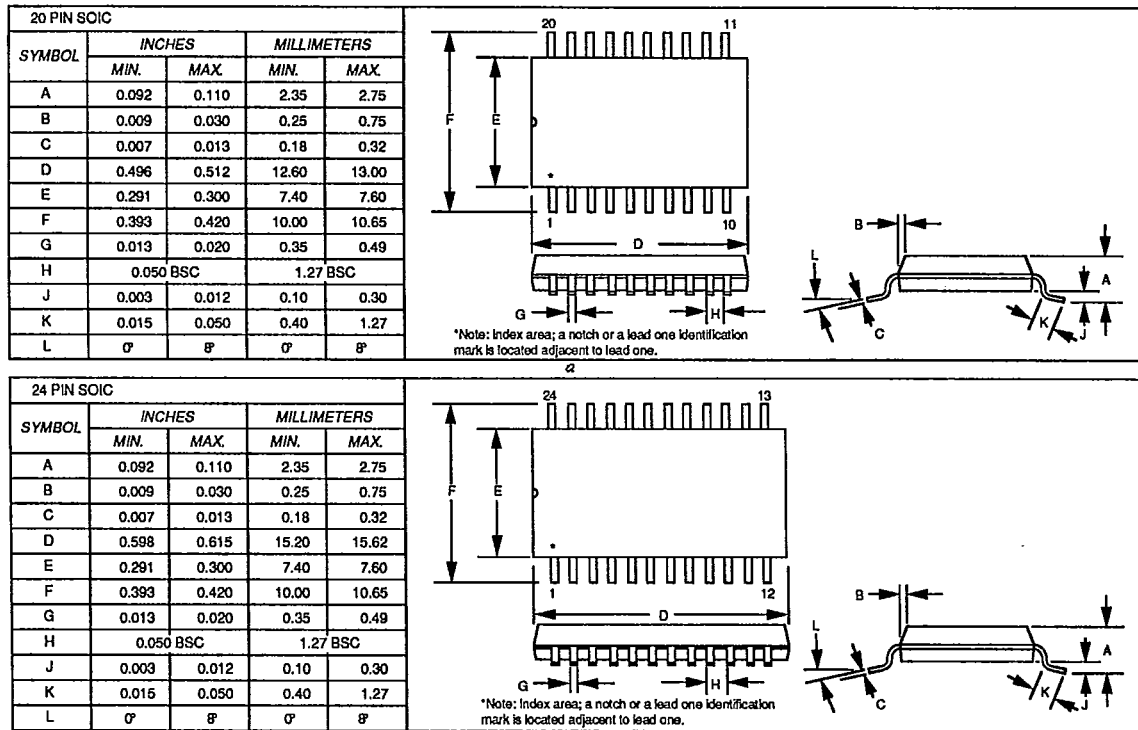


\*Note: Index area; a notch or a lead one identification mark is located adjacent to lead one.

PACKAGING  
AND ORDERING

PLASTIC SOIC

T-90-20

PACKAGING  
AND ORDERING