

# HD-4702/883

CMOS Programmable Bit Rate Generator

FN2955  
Rev 2.00  
June 1998

## Features

- This Circuit is Processed in Accordance to MIL-STD-883 and is Fully Conformant Under the Provisions of Paragraph 1. 2. 1.
- HD-4702/883 Provides 13 Commonly Used Bit Rates
- Uses a 2.4576MHz Crystal/Input for Standard Frequency Output (16 Times Bit Rate)
- Low Power Dissipation
- Conforms to EIA RS-404
- One HD-4702/883 Controls up to Eight Transmission Channels
- Initialization Circuit Facilitates Diagnostic Fault Isolation
- On-Chip Input Pull-Up Circuit

## Ordering Information

| PART NUMBER  | TEMPERATURE RANGE (°C) | PACKAGE | PKG. NO. |
|--------------|------------------------|---------|----------|
| HD1-4702/883 | -55 to 125             | CERDIP  | F16.3    |

## Description

The HD-4702/883 Bit Rate Generator provides the necessary clock signals for digital data transmission systems, such as a UART. It generates 13 commonly used bit rates using an on-chip crystal oscillator or an external input. For conventional operation generating 16 output clock pulses per bit period, the input clock frequency must be 2.4576MHz (i.e., 9600 Baud x 16 x 16, since there is an internal ÷ 16 prescaler). A lower input frequency will result in a proportionally lower output frequency.

The HD-4702/883 can provide multi-channel operation with a minimum of external logic by having the clock frequency  $C_O$  and the ÷ 8 prescaler outputs  $Q_0$ ,  $Q_1$ ,  $Q_2$  available externally. All signals have a 50% duty cycle except 1800 Baud, which has less than 0.39% distortion.

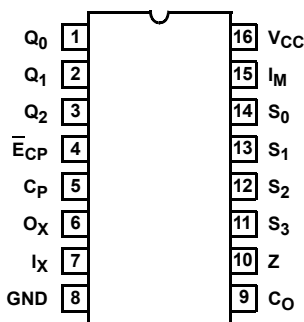
The four rate select inputs ( $S_0$ - $S_3$ ) select which bit rate is at the output (Z). See Truth Table for Rate Select Inputs for select code and output bit rate. Two of the 16 select codes for the HD-4702/883 do not select an internally generated frequency, but select an input into which the user can feed either a different frequency, or a static level (High or Low) to generate "ZERO BAUD".

The bit rates most commonly used in modern data terminals (110,150, 300,1200, 2400 Baud) require that no more than one input be grounded for the HD-4702/883, which is easily achieved with a single 5-position switch.

The HD-4702/883 has an initialization circuit which generates a master reset for the scan counter. This signal is derived from a digital differentiator that senses the first high level on the  $C_P$  input after the  $\bar{E}_{CP}$  input goes low. When  $\bar{E}_{CP}$  is high, selecting the crystal input,  $C_P$  must be low. A high level on  $C_P$  would apply a continuous reset. See Clock Modes and Initialization below.

## Pinout

HD-4702/883 (CERDIP)  
TOP VIEW



## Truth Table

**TRUTH TABLE FOR RATE SELECT INPUTS**

(Using 2.4576MHz Crystal)

| S <sub>3</sub> | S <sub>2</sub> | S <sub>1</sub> | S <sub>0</sub> | OUTPUT RATE (Z)             |
|----------------|----------------|----------------|----------------|-----------------------------|
| L              | L              | L              | L              | MUX Input (I <sub>M</sub> ) |
| L              | L              | L              | H              | MUX Input (I <sub>M</sub> ) |
| L              | L              | H              | L              | 50 Baud                     |
| L              | L              | H              | H              | 75 Baud                     |
| L              | H              | L              | L              | 134.5 Baud                  |
| L              | H              | L              | H              | 200 Baud                    |
| L              | H              | H              | L              | 600 Baud                    |
| L              | H              | H              | H              | 2400 Baud                   |
| H              | L              | L              | L              | 9600 Baud                   |
| H              | L              | L              | H              | 4800 Baud                   |
| H              | L              | H              | L              | 1800 Baud                   |
| H              | L              | H              | H              | 1200 Baud                   |
| H              | H              | L              | L              | 2400 Baud                   |
| H              | H              | L              | H              | 300 Baud                    |
| H              | H              | H              | L              | 150 Baud                    |
| H              | H              | H              | H              | 110 Baud                    |

NOTE:

1. 19200 Baud by connecting Q<sub>2</sub> to I<sub>M</sub>.

**CLOCK MODES AND INITIALIZATION**

| I <sub>X</sub>                                                                    | $\overline{E}_{CP}$ | C <sub>P</sub>                                                                      | OPERATION                                     |
|-----------------------------------------------------------------------------------|---------------------|-------------------------------------------------------------------------------------|-----------------------------------------------|
|  | H                   | L                                                                                   | Clocked from I <sub>X</sub>                   |
| X                                                                                 | L                   |  | Clocked from C <sub>P</sub>                   |
| X                                                                                 | H                   | H                                                                                   | Continuous Reset                              |
| X                                                                                 | L                   |  | Reset During First C <sub>P</sub> = High Time |

NOTE:

2. Actual output frequency is 16 times the indicated output rate, assuming a clock frequency of 2.4576MHz.

H = HIGH Level

L = LOW Level

X = Don't Care

 = Clock Pulse

 = First HIGH Level Clock Pulse after  $\overline{E}_{CP}$  goes LOW

**Absolute Maximum Ratings**

Supply Voltage ..... +8.0V  
 Input, Output or I/O Voltage ..... GND -0.5V to  $V_{CC} + 0.5V$   
 ESD Classification ..... Class 1  
 Typical Derating Factor ..... 1mA/MHz Increase in ICCOP

**Operating Conditions**

Operating Voltage Range ..... +4.5V to +5.5V  
 Operating Temperature Range ..... -55°C to 125°C

**Thermal Information**

Thermal Resistance, (Typical, Note 3)  $\theta_{JA}$  (°C/W)  $\theta_{JC}$  (°C/W)  
 CERDIP Package ..... 78 23  
 Maximum Storage Temperature Range ..... -65°C to 150°C  
 Maximum Junction Temperature ..... 175°C  
 Maximum Lead Temperature (Soldering, 10s) ..... 300°C

**Die Characteristics**

Gate Count ..... 720 Gates

*CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.*

**NOTE:**

3.  $\theta_{JA}$  is measured with the component mounted on an evaluation PC board in free air.

**TABLE 1. DC ELECTRICAL PERFORMANCE SPECIFICATIONS**

Device Guaranteed and 100% Tested

| DC PARAMETER                               | SYMBOL    | CONDITIONS                                                                                                 | GROUP A<br>SUB-<br>GROUPS | TEMPERATURE<br>(°C)     | MIN            | MAX           | UNITS   |
|--------------------------------------------|-----------|------------------------------------------------------------------------------------------------------------|---------------------------|-------------------------|----------------|---------------|---------|
| Input High Voltage                         | $V_{IH}$  | $V_{CC} = 4.5V$                                                                                            | 1, 2, 3                   | $-55 \leq T_A \leq 125$ | $V_{CC} 70\%$  | -             | V       |
| Input Low Voltage                          | $V_{IL}$  | $V_{CC} = 4.5V$                                                                                            | 1, 2, 3                   | $-55 \leq T_A \leq 125$ | -              | $V_{CC} 30\%$ | V       |
| Output High Voltage                        | $V_{OH1}$ | $I_{OH} \leq -1\mu A$ , $V_{CC} = 4.5V$ ,<br>(Note 4)                                                      | 1, 2, 3                   | $-55 \leq T_A \leq 125$ | $V_{CC} - 0.1$ | -             | V       |
| Output Low Voltage                         | $V_{OL1}$ | $I_{OL} \leq +1\mu A$ , $V_{CC} = 4.5V$ ,<br>(Note 4)                                                      | 1, 2, 3                   | $-55 \leq T_A \leq 125$ | -              | 0.1           | V       |
| Input High Current                         | $I_{IH}$  | $V_{IN} = V_{CC}$ . All Other Pins = 0V,<br>$V_{CC} = 5.5V$                                                | 1, 2, 3                   | $-55 \leq T_A \leq 125$ | -1             | +1            | $\mu A$ |
| Input Low Current<br>(IX Input)            | $I_{ILX}$ | $V_{IN} = 0V$ , All Other Pins = $V_{CC}$ ,<br>$V_{CC} = 5.5V$                                             | 1, 2, 3                   | $-55 \leq T_A \leq 125$ | -1             | +1            | $\mu A$ |
| Input Low Current<br>(All Other Inputs)    | $I_{IL}$  | $V_{IN} = 0V$ All Other Pins = $V_{CC}$ ,<br>$V_{CC} = 5.5V$ (Note 5)                                      | 1, 2, 3                   | $-55 \leq T_A \leq 125$ | -              | -100          | $\mu A$ |
| Output High Current<br>(OX)                | $I_{OHX}$ | $V_{OUT} = V_{CC} - 0.5$ , $V_{CC} = 4.5V$<br>Input at 0V or $V_{CC}$ per Logic<br>Function or Truth Table | 1, 2, 3                   | $-55 \leq T_A \leq 125$ | -0.1           | -             | mA      |
| Output High Current<br>(All Other Outputs) | $I_{OH1}$ | $V_{OUT} = 2.5V$ , $V_{CC} = 4.5V$<br>Input at 0V or $V_{CC}$ per Logic<br>Function or Truth Table         | 1, 2, 3                   | $-55 \leq T_A \leq 125$ | -1.0           | -             | mA      |
| Output High Current<br>(All Other Outputs) | $I_{OH2}$ | $V_{OUT} = V_{CC} - 0.5$ , $V_{CC} = 4.5V$<br>Input at 0V or $V_{CC}$ per Logic<br>Function or Truth Table | 1, 2, 3                   | $-55 \leq T_A \leq 125$ | -0.3           | -             | mA      |
| Output Low Current<br>(OX)                 | $I_{OLX}$ | $V_{OUT} = 0.4V$ , $V_{CC} = 4.5V$<br>Input at 0V or $V_{CC}$ per Logic<br>Function or Truth Table         | 1, 2, 3                   | $-55 \leq T_A \leq 125$ | 0.1            | -             | mA      |
| Output Low Current<br>(All Other Outputs)  | $I_{OL}$  | $V_{OUT} = 0.4V$ , $V_{CC} = 4.5V$<br>Input at 0V or $V_{CC}$ per Logic<br>Function or Truth Table         | 1, 2, 3                   | $-55 \leq T_A \leq 125$ | 1.6            | -             | mA      |

**TABLE 1. DC ELECTRICAL PERFORMANCE SPECIFICATIONS (Continued)**

Device Guaranteed and 100% Tested

| DC PARAMETER               | SYMBOL   | CONDITIONS                                                                                           | GROUP A<br>SUB-<br>GROUPS | TEMPERATURE<br>(°C)     | MIN | MAX  | UNITS   |
|----------------------------|----------|------------------------------------------------------------------------------------------------------|---------------------------|-------------------------|-----|------|---------|
| Supply Current<br>(Static) | $I_{CC}$ | $\bar{E}_{CP} = V_{CC}$ , $C_P = 0V$ ,<br>$V_{CC} = 5.5V$<br>All Other Inputs = GND,<br>(Note 5)     | 1, 2, 3                   | $-55 \leq T_A \leq 125$ | -   | 1500 | $\mu A$ |
|                            |          | $\bar{E}_{CP} = V_{CC}$ , $C_P = 0V$ ,<br>$V_{CC} = 5.5V$<br>All Other Inputs = $V_{CC}$<br>(Note 5) | 1, 2, 3                   | $-55 \leq T_A \leq 125$ | -   | 1000 | $\mu A$ |

NOTES:

- Interchanging of force and sense conditions is permitted.
- Input Current and Quiescent Power Supply Current are relatively higher for this device because of active pull-up circuits on all inputs except  $I_X$ .

**TABLE 2. AC ELECTRICAL PERFORMANCE SPECIFICATIONS**

Device Guaranteed and 100% Tested.

| AC PARAMETER                                    | SYMBOL       | CONDITIONS                                                             | GROUP A<br>SUBGROUPS | TEMPERATURE<br>(°C)     | MIN | MAX      | UNITS |
|-------------------------------------------------|--------------|------------------------------------------------------------------------|----------------------|-------------------------|-----|----------|-------|
| Propagation Delay, $I_X$ to $C_O$               | $t_{PLH}$    | $V_{CC} = 4.5V$<br>$C_L \leq 7pF$ on $O_X$<br>$C_L = 50pF$<br>(Note 6) | 9, 10, 11            | $-55 \leq T_A \leq 125$ | -   | 350      | ns    |
| Propagation Delay, $I_X$ to $C_O$               | $t_{PHL}$    |                                                                        | 9, 10, 11            | $-55 \leq T_A \leq 125$ | -   | 275      | ns    |
| Propagation Delay, $C_P$ to $C_O$               | $t_{PLH}$    |                                                                        | 9, 10, 11            | $-55 \leq T_A \leq 125$ | -   | 260      | ns    |
| Propagation Delay, $C_P$ to $C_O$               | $t_{PHL}$    |                                                                        | 9, 10, 11            | $-55 \leq T_A \leq 125$ | -   | 220      | ns    |
| Propagation Delay, $C_O$ to $Q_n$               | $t_{PLH}$    |                                                                        | 9, 10, 11            | $-55 \leq T_A \leq 125$ | -   | (Note 7) | ns    |
| Propagation Delay, $C_O$ to $Q_n$               | $t_{PHL}$    |                                                                        | 9, 10, 11            | $-55 \leq T_A \leq 125$ | -   | (Note 7) | ns    |
| Propagation Delay, $C_O$ to Z                   | $t_{PLH}$    |                                                                        | 9, 10, 11            | $-55 \leq T_A \leq 125$ | -   | 85       | ns    |
| Propagation Delay, $C_O$ to Z                   | $t_{PHL}$    |                                                                        | 9, 10, 11            | $-55 \leq T_A \leq 125$ | -   | 75       | ns    |
| Output Transition Time (Except $O_X$ )          | $t_{TLH}$    |                                                                        | 9, 10, 11            | $-55 \leq T_A \leq 125$ |     | 160      | ns    |
| Output Transition Time (Except $O_X$ )          | $t_{THL}$    |                                                                        | 9, 10, 11            | $-55 \leq T_A \leq 125$ | -   | 75       | ns    |
| Set-Up Time Select to $C_O$                     | $t_S$        |                                                                        | 9, 10, 11            | $-55 \leq T_A \leq 125$ | 350 | -        | ns    |
| Hold Time, Select to $C_O$                      | $t_H$        |                                                                        | 9, 10, 11            | $-55 \leq T_A \leq 125$ | 0   | -        | ns    |
| Set-Up Time, $I_M$ to $C_O$                     | $t_S$        |                                                                        | 9, 10, 11            | $-55 \leq T_A \leq 125$ | 350 | -        | ns    |
| Hold Time, $I_M$ to $C_O$                       | $t_H$        |                                                                        | 9, 10, 11            | $-55 \leq T_A \leq 125$ | 0   | -        | ns    |
| Minimum Clock Pulse Width, Low<br>(Notes 8, 9)  | $t_{WCP(L)}$ |                                                                        | 9, 10, 11            | $-55 \leq T_A \leq 125$ | 120 |          | ns    |
| Minimum Clock Pulse Width, High<br>(Notes 8, 9) | $t_{WCP(H)}$ |                                                                        | 9, 10, 11            | $-55 \leq T_A \leq 125$ | 120 | -        | ns    |
| Minimum $I_X$ Pulse Width, Low (Note 9)         | $t_{WCP(L)}$ |                                                                        | 9, 10, 11            | $-55 \leq T_A \leq 125$ | 160 | -        | ns    |
| Minimum $I_X$ Pulse Width, High (Note 9)        | $t_{WCP(H)}$ |                                                                        | 9, 10, 11            | $-55 \leq T_A \leq 125$ | 160 | -        | ns    |

NOTES:

- Propagation Delays ( $t_{PLH}$  and  $t_{PHL}$ ) and Output Transition Times ( $t_{TLH}$  and  $t_{THL}$ ) will change with Output Load Capacitance ( $C_L$ ). Set-Up Times ( $t_S$ ), Hold Times ( $t_H$ ), and Minimum Pulse Widths ( $t_W$ ) do not vary with load capacitance.
- For multichannel operation, Propagation Delay ( $C_O$  to  $Q_n$ ), plus Set-Up Time, Select to  $C_O$ , is guaranteed to be  $\leq 367ns$ .
- The first High Level Clock Pulse after  $\bar{E}_{CP}$  goes Low must be at least 350ns long to guarantee reset of all Counters.
- It is recommended that input rise and fall times to the clock inputs ( $C_P$ ,  $I_X$ ) be less than 15ns.

TABLE 3. ELECTRICAL PERFORMANCE SPECIFICATIONS

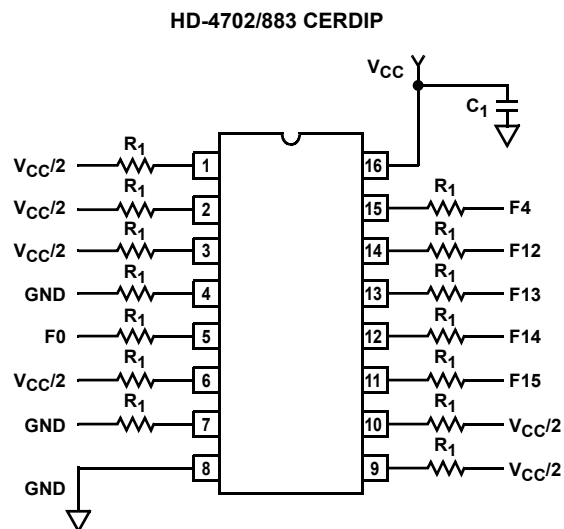
| AC PARAMETER                           | SYMBOL    | CONDITIONS                                                                      | NOTES  | TEMPERATURE (°C)        | MIN | MAX       | UNITS |
|----------------------------------------|-----------|---------------------------------------------------------------------------------|--------|-------------------------|-----|-----------|-------|
| Input Capacitance                      | $C_{IN}$  | All Measurements are referenced to device ground, $f = 1\text{MHz}$ .           | 10     | $T_A = 25$              | -   | 7.0       | pF    |
| Output Capacitance                     | $C_O$     |                                                                                 | 10     | $T_A = 25$              | -   | 15.0      | pF    |
| Propagation Delay $I_X$ to $C_O$       | $t_{PLH}$ | $V_{CC} = 4.5\text{V}$<br>$C_L \leq 7\text{pF}$ on $O_X$<br>$C_L = 15\text{pF}$ | 10, 12 | $-55 \leq T_A \leq 125$ | -   | 300       | ns    |
| Propagation Delay $I_X$ to $C_O$       | $t_{PHL}$ |                                                                                 | 10, 12 | $-55 \leq T_A \leq 125$ | -   | 250       | ns    |
| Propagation Delay $C_P$ to $C_O$       | $t_{PLH}$ |                                                                                 | 10, 12 | $-55 \leq T_A \leq 125$ | -   | 215       | ns    |
| Propagation Delay $C_P$ to $C_O$       | $t_{PHL}$ |                                                                                 | 10, 12 | $-55 \leq T_A \leq 125$ | -   | 195       | ns    |
| Propagation Delay $C_O$ to $Q_n$       | $t_{PLH}$ |                                                                                 | 10, 12 | $-55 \leq T_A \leq 125$ | -   | (Note 11) | ns    |
| Propagation Delay $C_O$ to $Q_n$       | $t_{PHL}$ |                                                                                 | 10, 12 | $-55 \leq T_A \leq 125$ | -   | (Note 11) | ns    |
| Propagation Delay $C_O$ to Z           | $t_{PLH}$ |                                                                                 | 10, 12 | $-55 \leq T_A \leq 125$ | -   | 75        | ns    |
| Propagation Delay $C_O$ to Z           | $t_{PHL}$ |                                                                                 | 10, 12 | $-55 \leq T_A \leq 125$ | -   | 65        | ns    |
| Output Transition Time (Except $O_X$ ) | $t_{TLH}$ |                                                                                 | 10, 12 | $-55 \leq T_A \leq 125$ | -   | 80        | ns    |
| Output Transition Time (Except $O_X$ ) | $t_{THL}$ |                                                                                 | 10, 12 | $-55 \leq T_A \leq 125$ | -   | 40        | ns    |

## NOTES:

10. The parameters listed in Table 3 are controlled via design or process parameters and are not directly tested. These parameters are characterized upon initial design and after major process and/or design changes.
11. For multichannel operation, Propagation Delay ( $C_O$  to  $Q_n$ ) plus Set-Up Time, Select to  $C_O$ , is guaranteed to be  $\leq 367\text{ns}$ .
12. Propagation Delays ( $t_{PLH}$  and  $t_{PHL}$ ) and Output Transition Times ( $t_{TLH}$  and  $t_{THL}$ ) will change with Output Load Capacitance ( $C_L$ ). Set-Up Times ( $t_S$ ), Hold Times ( $t_H$ ), and Minimum Pulse Widths ( $t_W$ ) do not vary with load capacitance.

TABLE 4. APPLICABLE SUBGROUPS

| CONFORMANCE GROUPS | METHOD       | SUBGROUPS                     |
|--------------------|--------------|-------------------------------|
| Initial Test       | 100%/5004    | -                             |
| Interim Test       | 100%/5004    | 1, 7, 9                       |
| PDA                | 100%         | 1                             |
| Final Test         | 100%         | 2, 3, 8A, 8B, 10, 11          |
| Group A            | -            | 1, 2, 3, 7, 8A, 8B, 9, 10, 11 |
| Groups C and D     | Samples/5005 | 1, 7, 9                       |

**Burn-In Circuit**

## NOTES:

13.  $F_0 = 100\text{kHz} \pm 10\%$ ,  $F_1 = F_0/2$ ,  $F_2 = F_1/2$ , ...

14.  $R_1 = 10\text{k}\Omega$ ,  $1/4\text{W}$ ,  $\pm 10\%$ .

15.  $V_{CC} = 5.5\text{V} \pm 0.5\text{V}$ , GND = 0V.

16.  $C_1 = 0.01\mu\text{F}$  Min.

## Die Characteristics

### DIE DIMENSIONS:

100 mils x 97 mils x 19 mils

### METALLIZATION:

Type: Si - Al

Thickness: 10kÅ - 12kÅ

### GLASSIVATION:

Type: SiO<sub>2</sub>

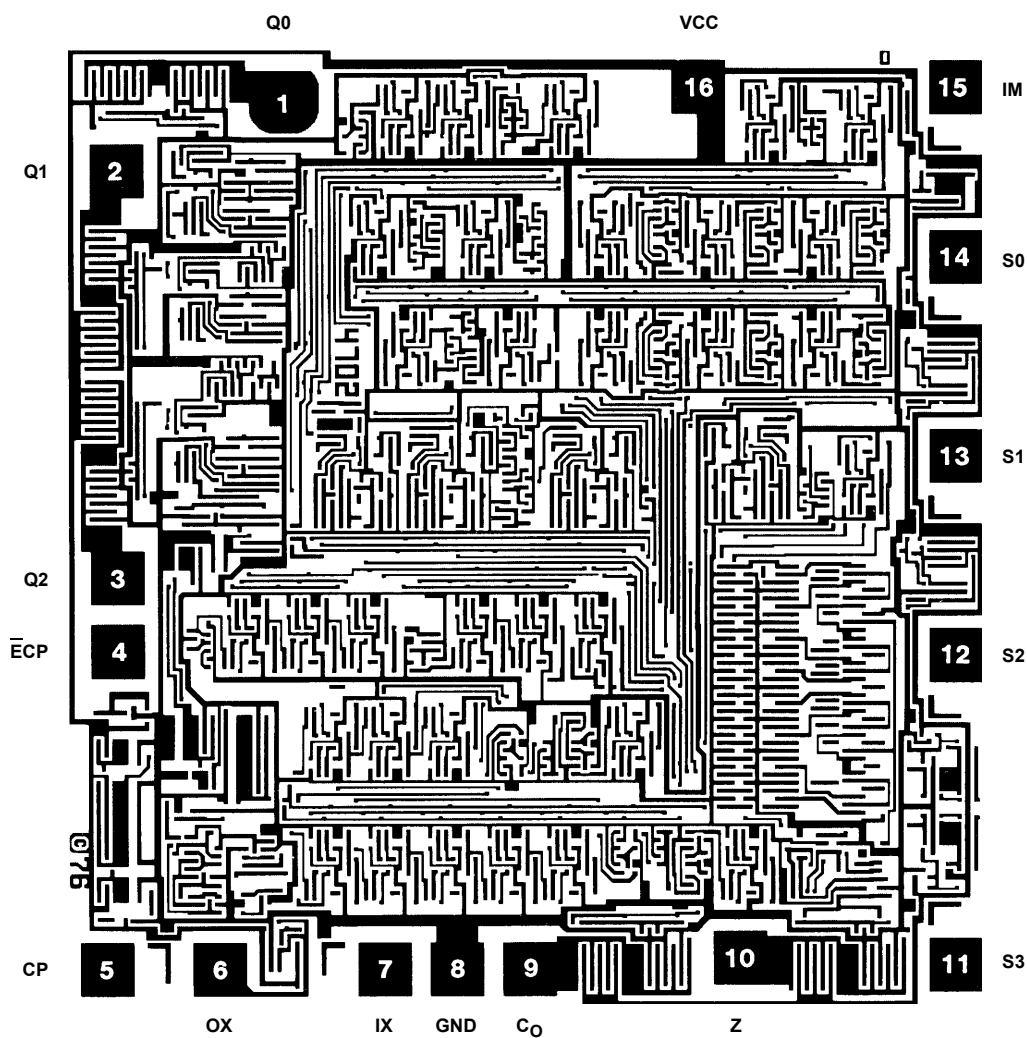
Thickness: 7kÅ - 9kÅ

### WORST CASE CURRENT DENSITY:

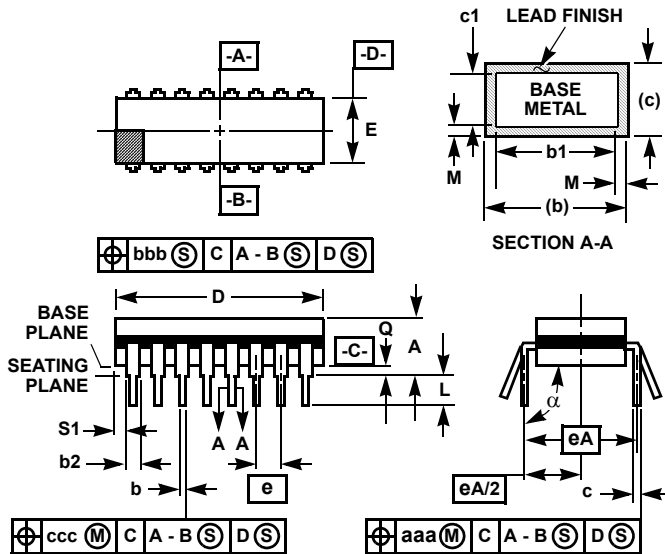
$7.1 \times 10^4 \text{ A/cm}^2$

## Metallization Mask Layout

HD-4702/883



Ceramic Dual-In-Line Frit Seal Packages (CERDIP)



NOTES:

1. Index area: A notch or a pin one identification mark shall be located adjacent to pin one and shall be located within the shaded area shown. The manufacturer's identification shall not be used as a pin one identification mark.
2. The maximum limits of lead dimensions b and c or M shall be measured at the centroid of the finished lead surfaces, when solder dip or tin plate lead finish is applied.
3. Dimensions b1 and c1 apply to lead base metal only. Dimension M applies to lead plating and finish thickness.
4. Corner leads (1, N, N/2, and N/2+1) may be configured with a partial lead paddle. For this configuration dimension b3 replaces dimension b2.
5. This dimension allows for off-center lid, meniscus, and glass overrun.
6. Dimension Q shall be measured from the seating plane to the base plane.
7. Measure dimension S1 at all four corners.
8. N is the maximum number of terminal positions.
9. Dimensioning and tolerancing per ANSI Y14.5M - 1982.
10. Controlling dimension: INCH.

F16.3 MIL-STD-1835 GDIP1-T16 (D-2, CONFIGURATION A)  
16 LEAD CERAMIC DUAL-IN-LINE FRIT SEAL PACKAGE

| SYMBOL   | INCHES    |        | MILLIMETERS |       | NOTES |
|----------|-----------|--------|-------------|-------|-------|
|          | MIN       | MAX    | MIN         | MAX   |       |
| A        | -         | 0.200  | -           | 5.08  | -     |
| b        | 0.014     | 0.026  | 0.36        | 0.66  | 2     |
| b1       | 0.014     | 0.023  | 0.36        | 0.58  | 3     |
| b2       | 0.045     | 0.065  | 1.14        | 1.65  | -     |
| b3       | 0.023     | 0.045  | 0.58        | 1.14  | 4     |
| c        | 0.008     | 0.018  | 0.20        | 0.46  | 2     |
| c1       | 0.008     | 0.015  | 0.20        | 0.38  | 3     |
| D        | -         | 0.840  | -           | 21.34 | 5     |
| E        | 0.220     | 0.310  | 5.59        | 7.87  | 5     |
| e        | 0.100 BSC |        | 2.54 BSC    |       | -     |
| eA       | 0.300 BSC |        | 7.62 BSC    |       | -     |
| eA/2     | 0.150 BSC |        | 3.81 BSC    |       | -     |
| L        | 0.125     | 0.200  | 3.18        | 5.08  | -     |
| Q        | 0.015     | 0.060  | 0.38        | 1.52  | 6     |
| S1       | 0.005     | -      | 0.13        | -     | 7     |
| $\alpha$ | 90°       | 105°   | 90°         | 105°  | -     |
| aaa      | -         | 0.015  | -           | 0.38  | -     |
| bbb      | -         | 0.030  | -           | 0.76  | -     |
| ccc      | -         | 0.010  | -           | 0.25  | -     |
| M        | -         | 0.0015 | -           | 0.038 | 2, 3  |
| N        | 16        |        | 16          |       | 8     |

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