

5962-E1682

## 1. SCOPE

1.1 Scope. This drawing describes device requirements for class B microcircuits in accordance with 1.2.1 of MIL-STD-883, "Provisions for the use of MIL-STD-883 in conjunction with compliant non-JAN devices".

1.2 Part number. The complete part number shall be as shown in the following example:

|                |                        |                         |                                |
|----------------|------------------------|-------------------------|--------------------------------|
| 5962-89946     | 01                     | E                       | X                              |
| -----          | -----                  | -----                   | -----                          |
| Drawing number | Device type<br>(1.2.1) | Case outline<br>(1.2.2) | Lead finish per<br>MIL-M-38510 |

1.2.1 Device type. The device type shall identify the circuit function as follows:

| Device type | Generic number | Circuit function                          |
|-------------|----------------|-------------------------------------------|
| 01          | 54HC190        | 4-bit synchronous, decade up/down counter |

1.2.2 Case outlines. The case outlines shall be as designated in appendix C of MIL-M-38510, and as follows:

| Outline letter | Case outline                                                           |
|----------------|------------------------------------------------------------------------|
| E              | D-2 (16-lead, .840" x .310" x .200"), dual-in-line package             |
| 2              | C-2 (20-terminal .358" x .358" x .100"), leadless chip carrier package |

## 1.3 Absolute maximum ratings. 1/

|                                                                  |                                  |
|------------------------------------------------------------------|----------------------------------|
| Supply voltage range - - - - -                                   | -0.5 V dc to +7.0 V dc           |
| DC input voltage range - - - - -                                 | -0.5 V dc to $V_{CC} + 0.5$ V dc |
| DC output voltage range - - - - -                                | -0.5 V dc to $V_{CC} + 0.5$ V dc |
| Clamp diode current - - - - -                                    | ±20 mA                           |
| DC output current (per pin) - - - - -                            | ±25 mA                           |
| DC $V_{CC}$ or GND current (per pin) - - - - -                   | ±50 mA                           |
| Storage temperature range - - - - -                              | -65°C to +150°C                  |
| Maximum power dissipation ( $P_D$ ) 2/ - - - - -                 | 500 mW                           |
| Lead temperature (soldering, 10 seconds) - - - - -               | +260°C                           |
| Thermal resistance, junction-to-case ( $\theta_{JC}$ ) - - - - - | See MIL-M-38510, appendix C      |
| Junction temperature ( $T_J$ ) - - - - -                         | +175°C                           |

## 1.4 Recommended operating conditions.

|                                                      |                        |
|------------------------------------------------------|------------------------|
| Supply voltage range - - - - -                       | +2.0 V dc to +6.0 V dc |
| Input voltage range ( $V_{IN}$ ) - - - - -           | 0.0 V to $V_{CC}$      |
| Output voltage range ( $V_{OUT}$ ) - - - - -         | 0.0 V to $V_{CC}$      |
| Case operating temperature range ( $T_C$ ) - - - - - | -55°C to +125°C        |
| Input rise or fall time:                             |                        |
| $T_C = -55^\circ\text{C}$ to $+125^\circ\text{C}$ :  |                        |
| $V_{CC} = 2.0$ V - - - - -                           | 0 to 500 ns            |
| $V_{CC} = 4.5$ V - - - - -                           | 0 to 500 ns            |
| $V_{CC} = 6.0$ V - - - - -                           | 0 to 400 ns            |

1/ Unless otherwise specified, all voltages are referenced to ground.

2/ For  $T_C = +100^\circ\text{C}$  to  $+125^\circ\text{C}$ , derate linearly at 12 mW/°C.

|                                                                                                     |                  |            |            |
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Minimum pulse width, CP ( $t_{w1}$ ): $T_C = +25^\circ\text{C}$ : $V_{CC} = 2.0\text{ V dc}$  - - - - - 125 ns $V_{CC} = 4.5\text{ V dc}$  - - - - - 25 ns $V_{CC} = 6.0\text{ V dc}$  - - - - - 21 ns $T_C = -55^\circ\text{C}, +125^\circ\text{C}$ : $V_{CC} = 2.0\text{ V dc}$  - - - - - 190 ns $V_{CC} = 4.5\text{ V dc}$  - - - - - 38 ns $V_{CC} = 6.0\text{ V dc}$  - - - - - 32 nsMinimum pulse width,  $\overline{\text{LOAD}}$  ( $t_{w2}$ ): $T_C = +25^\circ\text{C}$ : $V_{CC} = 2.0\text{ V dc}$  - - - - - 120 ns $V_{CC} = 4.5\text{ V dc}$  - - - - - 24 ns $V_{CC} = 6.0\text{ V dc}$  - - - - - 20 ns $T_C = -55^\circ\text{C}, +125^\circ\text{C}$ : $V_{CC} = 2.0\text{ V dc}$  - - - - - 180 ns $V_{CC} = 4.5\text{ V dc}$  - - - - - 36 ns $V_{CC} = 6.0\text{ V dc}$  - - - - - 31 nsMinimum setup time, Dn to  $\overline{\text{LOAD}}$  ( $t_{s1}$ ): $T_C = +25^\circ\text{C}$ : $V_{CC} = 2.0\text{ V dc}$  - - - - - 150 ns $V_{CC} = 4.5\text{ V dc}$  - - - - - 30 ns $V_{CC} = 6.0\text{ V dc}$  - - - - - 25 ns $T_C = -55^\circ\text{C to } +125^\circ\text{C}$ : $V_{CC} = 2.0\text{ V dc}$  - - - - - 225 ns $V_{CC} = 4.5\text{ V dc}$  - - - - - 45 ns $V_{CC} = 6.0\text{ V dc}$  - - - - - 38 nsMaximum operating frequency ( $f_{\text{max}}$ ): $T_C = +25^\circ\text{C}$ : $V_{CC} = 2.0\text{ V dc}$  - - - - - 4.2 MHz $V_{CC} = 4.5\text{ V dc}$  - - - - - 21 MHz $V_{CC} = 6.0\text{ V dc}$  - - - - - 24 MHz $T_C = -55^\circ\text{C to } +125^\circ\text{C}$ : $V_{CC} = 2.0\text{ V dc}$  - - - - - 2.8 MHz $V_{CC} = 4.5\text{ V dc}$  - - - - - 14 MHz $V_{CC} = 6.0\text{ V dc}$  - - - - - 16 MHzMinimum setup time, Down/ $\overline{\text{Up}}$  to CLK ( $t_{s2}$ ): $T_C = +25^\circ\text{C}$ : $V_{CC} = 2.0\text{ V dc}$  - - - - - 205 ns $V_{CC} = 4.5\text{ V dc}$  - - - - - 41 ns $V_{CC} = 6.0\text{ V dc}$  - - - - - 35 ns $T_C = -55^\circ\text{C}, +125^\circ\text{C}$ : $V_{CC} = 2.0\text{ V dc}$  - - - - - 306 ns $V_{CC} = 4.5\text{ V dc}$  - - - - - 61 ns $V_{CC} = 6.0\text{ V dc}$  - - - - - 53 nsMinimum setup time,  $\overline{\text{Enable}}$  to CLK ( $t_{s3}$ ): $T_C = +25^\circ\text{C}$ : $V_{CC} = 2.0\text{ V dc}$  - - - - - 205 ns $V_{CC} = 4.5\text{ V dc}$  - - - - - 41 ns $V_{CC} = 6.0\text{ V dc}$  - - - - - 35 ns $T_C = -55^\circ\text{C to } +125^\circ\text{C}$ : $V_{CC} = 2.0\text{ V dc}$  - - - - - 306 ns $V_{CC} = 4.5\text{ V dc}$  - - - - - 61 ns $V_{CC} = 6.0\text{ V dc}$  - - - - - 53 ns**STANDARDIZED  
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Minimum recovery time  $\overline{\text{LOAD}}$  from CLK ( $t_{\text{rec}}$ ):

|                                                    |        |
|----------------------------------------------------|--------|
| $T_C = +25^\circ\text{C}$ :                        |        |
| $V_{CC} = 2.0\text{ V dc}$                         | 150 ns |
| $V_{CC} = 4.5\text{ V dc}$                         | 30 ns  |
| $V_{CC} = 6.0\text{ V dc}$                         | 25 ns  |
| $T_C = -55^\circ\text{C to } +125^\circ\text{C}$ : |        |
| $V_{CC} = 2.0\text{ V dc}$                         | 225 ns |
| $V_{CC} = 4.5\text{ V dc}$                         | 45 ns  |
| $V_{CC} = 6.0\text{ V dc}$                         | 38 ns  |

Minimum hold time, Dn to  $\overline{\text{LOAD}}$  ( $t_{h1}$ ):

|                                                    |       |
|----------------------------------------------------|-------|
| $T_C = +25^\circ\text{C}$ :                        |       |
| $V_{CC} = 2.0\text{ V dc}$                         | 25 ns |
| $V_{CC} = 4.5\text{ V dc}$                         | 5 ns  |
| $V_{CC} = 6.0\text{ V dc}$                         | 5 ns  |
| $T_C = -55^\circ\text{C to } +125^\circ\text{C}$ : |       |
| $V_{CC} = 2.0\text{ V dc}$                         | 40 ns |
| $V_{CC} = 4.5\text{ V dc}$                         | 8 ns  |
| $V_{CC} = 6.0\text{ V dc}$                         | 7 ns  |

Minimum hold time,  $\overline{\text{Enable}}$  to CLK ( $t_{h2}$ ):

|                                                  |      |
|--------------------------------------------------|------|
| $T_C = +25^\circ\text{C}$ :                      |      |
| $V_{CC} = 2.0\text{ V dc}$                       | 5 ns |
| $V_{CC} = 4.5\text{ V dc}$                       | 5 ns |
| $V_{CC} = 6.0\text{ V dc}$                       | 5 ns |
| $T_C = -55^\circ\text{C, } +125^\circ\text{C}$ : |      |
| $V_{CC} = 2.0\text{ V dc}$                       | 5 ns |
| $V_{CC} = 4.5\text{ V dc}$                       | 5 ns |
| $V_{CC} = 6.0\text{ V dc}$                       | 5 ns |

Minimum hold time, Down/ $\overline{\text{Up}}$  to CLK ( $t_{h3}$ ):

|                                                    |      |
|----------------------------------------------------|------|
| $T_C = +25^\circ\text{C}$ :                        |      |
| $V_{CC} = 2.0\text{ V dc}$                         | 5 ns |
| $V_{CC} = 4.5\text{ V dc}$                         | 5 ns |
| $V_{CC} = 6.0\text{ V dc}$                         | 5 ns |
| $T_C = -55^\circ\text{C to } +125^\circ\text{C}$ : |      |
| $V_{CC} = 2.0\text{ V dc}$                         | 5 ns |
| $V_{CC} = 4.5\text{ V dc}$                         | 5 ns |
| $V_{CC} = 6.0\text{ V dc}$                         | 5 ns |

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## 2. APPLICABLE DOCUMENTS

2.1 Government specification, standard, and bulletin. Unless otherwise specified, the following specification, standard, and bulletin of the issue listed in that issue of the Department of Defense Index of Specifications and Standards specified in the solicitation, form a part of this drawing to the extent specified herein.

### SPECIFICATION

#### MILITARY

MIL-M-38510 - Microcircuits, General Specification for.

### STANDARD

#### MILITARY

MIL-STD-883 - Test Methods and Procedures for Microelectronics.

### BULLETIN

#### MILITARY

MIL-BUL-103 - List of Standardized Military Drawing (SMD's).

(Copies of the specification, standard, and bulletin required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

2.2 Order of precedence. In the event of a conflict between the text of this drawing and the references cited herein, the text of this drawing shall take precedence.

## 3. REQUIREMENTS

3.1 Item requirements. The individual item requirements shall be in accordance with 1.2.1 of MIL-STD-883, "Provisions for the use of MIL-STD-883 in conjunction with compliant non-JAN devices" and as specified herein.

3.2 Design, construction, and physical dimensions. The design, construction, and physical dimensions shall be as specified in MIL-M-38510 and herein.

3.2.1 Terminal connections. The terminal connections shall be as specified on figure 1.

3.2.2 Truth table. The truth table shall be as specified on figure 2.

3.2.3 Logic diagram. The functional diagram shall be as specified on figure 3.

3.2.4 Counting sequence. The counting sequence diagram shall be as specified on figure 4.

3.2.5 Case outlines. The case outlines shall be in accordance with 1.2.2 herein.

3.3 Electrical performance characteristics. Unless otherwise specified herein, the electrical performance characteristics are as specified in table I and apply over the full case operating temperature range.

3.4 Electrical test requirements. The electrical test requirements shall be the subgroups specified in table II. The electrical tests for each subgroup are described in table I.

|                                                                                                     |                  |                |            |
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TABLE I. Electrical performance characteristics.

| Test                           | Symbol          | Conditions<br>-55°C < T <sub>C</sub> < +125°C<br>unless otherwise specified                           |                         | Group A<br>subgroups | Limits |     | Unit |
|--------------------------------|-----------------|-------------------------------------------------------------------------------------------------------|-------------------------|----------------------|--------|-----|------|
|                                |                 |                                                                                                       |                         |                      | Min    | Max |      |
| High level output<br>voltage   | V <sub>OH</sub> | V <sub>IN</sub> = V <sub>IH</sub> minimum<br>or V <sub>IL</sub> maximum<br> I <sub>O</sub>   ≤ 20 μA  | V <sub>CC</sub> = 2.0 V | 1, 2, 3              | 1.9    |     | V    |
|                                |                 |                                                                                                       | V <sub>CC</sub> = 4.5 V |                      | 4.4    |     |      |
|                                |                 |                                                                                                       | V <sub>CC</sub> = 6.0 V |                      | 5.9    |     |      |
|                                |                 | V <sub>IN</sub> = V <sub>IH</sub> minimum<br>or V <sub>IL</sub> maximum<br> I <sub>O</sub>   ≤ 4.0 mA | V <sub>CC</sub> = 4.5 V |                      | 3.7    |     |      |
|                                |                 |                                                                                                       | V <sub>CC</sub> = 6.0 V |                      | 5.2    |     |      |
| Low level output<br>voltage    | V <sub>OL</sub> | V <sub>IN</sub> = V <sub>IH</sub> minimum<br>or V <sub>IL</sub> maximum<br> I <sub>O</sub>   ≤ 20 μA  | V <sub>CC</sub> = 2.0 V | 1, 2, 3              |        | 0.1 | V    |
|                                |                 |                                                                                                       | V <sub>CC</sub> = 4.5 V |                      |        | 0.1 |      |
|                                |                 |                                                                                                       | V <sub>CC</sub> = 6.0 V |                      |        | 0.1 |      |
|                                |                 | V <sub>IN</sub> = V <sub>IH</sub> minimum<br>or V <sub>IL</sub> maximum<br> I <sub>O</sub>   ≤ 4.0 mA | V <sub>CC</sub> = 4.5 V |                      |        | 0.4 |      |
|                                |                 |                                                                                                       | V <sub>CC</sub> = 6.0 V |                      |        | 0.4 |      |
| High level input<br>voltage 2/ | V <sub>IH</sub> |                                                                                                       | V <sub>CC</sub> = 2.0 V | 1, 2, 3              | 1.5    |     | V    |
|                                |                 |                                                                                                       | V <sub>CC</sub> = 4.5 V |                      | 3.15   |     |      |
|                                |                 |                                                                                                       | V <sub>CC</sub> = 6.0 V |                      | 4.2    |     |      |

See footnotes at end of table.

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TABLE I. Electrical performance characteristics - Continued.

| Test                                                 | Symbol                                   | Conditions <sup>1/</sup><br>-55°C < T <sub>C</sub> < +125°C<br>unless otherwise specified |                         | Group A<br>subgroups | Limits |      | Unit |
|------------------------------------------------------|------------------------------------------|-------------------------------------------------------------------------------------------|-------------------------|----------------------|--------|------|------|
|                                                      |                                          |                                                                                           |                         |                      | Min    | Max  |      |
| Low level input<br>voltage <u>2/</u>                 | V <sub>IL</sub>                          |                                                                                           | V <sub>CC</sub> = 2.0 V | 1, 2, 3              |        | 0.3  | V    |
|                                                      |                                          |                                                                                           | V <sub>CC</sub> = 4.5 V |                      |        | 0.9  |      |
|                                                      |                                          |                                                                                           | V <sub>CC</sub> = 6.0 V |                      |        | 1.2  |      |
| Quiescent supply<br>current (standby)                | I <sub>CC</sub>                          | V <sub>IN</sub> = V <sub>CC</sub> or GND<br>I <sub>OUT</sub> = 0 μA                       | V <sub>CC</sub> = 6.0 V | 1, 2, 3              |        | 160  | μA   |
| Input leakage<br>current                             | I <sub>IN</sub>                          | V <sub>CC</sub> = 6.0 V<br>V <sub>IN</sub> = V <sub>CC</sub> or GND                       |                         | 1, 2, 3              |        | ±1.0 | μA   |
| Functional tests                                     |                                          | See 4.3.1d                                                                                |                         | 7, 8                 |        |      |      |
| Propagation delay<br>time, Enable to<br>RC <u>3/</u> | t <sub>PHL1</sub> ,<br>t <sub>PLH1</sub> | T <sub>C</sub> = +25°C<br>C <sub>L</sub> = 50 pF<br>See figure 5                          | V <sub>CC</sub> = 2.0 V | 9                    |        | 132  | ns   |
|                                                      |                                          |                                                                                           | V <sub>CC</sub> = 4.5 V |                      |        | 26   |      |
|                                                      |                                          |                                                                                           | V <sub>CC</sub> = 6.0 V |                      |        | 23   |      |
|                                                      |                                          | T <sub>C</sub> = -55°C, +125°C<br>C <sub>L</sub> = 50 pF<br>See figure 5                  | V <sub>CC</sub> = 2.0 V | 10, 11               |        | 198  |      |
|                                                      |                                          |                                                                                           | V <sub>CC</sub> = 4.5 V |                      |        | 40   |      |
|                                                      |                                          |                                                                                           | V <sub>CC</sub> = 6.0 V |                      |        | 34   |      |
| Propagation delay<br>time, LOAD to Qn<br><u>3/</u>   | t <sub>PHL2</sub> ,<br>t <sub>PLH2</sub> | T <sub>C</sub> = +25°C<br>C <sub>L</sub> = 50 pF<br>See figure 5                          | V <sub>CC</sub> = 2.0 V | 9                    |        | 264  | ns   |
|                                                      |                                          |                                                                                           | V <sub>CC</sub> = 4.5 V |                      |        | 53   |      |
|                                                      |                                          |                                                                                           | V <sub>CC</sub> = 6.0 V |                      |        | 45   |      |

See footnotes at end of table.

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TABLE I. Electrical performance characteristics - Continued.

| Test                                               | Symbol                                   | Conditions<br>-55°C < T <sub>C</sub> < +125°C<br>unless otherwise specified | Group A<br>subgroups | Limits |     | Unit |
|----------------------------------------------------|------------------------------------------|-----------------------------------------------------------------------------|----------------------|--------|-----|------|
|                                                    |                                          |                                                                             |                      | Min    | Max |      |
| Propagation delay<br>time, <u>LOAD</u> to Qn<br>3/ | t <sub>PHL2</sub> ,<br>t <sub>PLH2</sub> | T <sub>C</sub> = -55°C, +125°C<br>C <sub>L</sub> = 50 pF<br>See figure 5    | 10, 11               |        | 396 | ns   |
|                                                    |                                          |                                                                             |                      |        | 79  |      |
|                                                    |                                          |                                                                             |                      |        | 67  |      |
| Propagation delay<br>time, Dn to Qn<br>3/          | t <sub>PHL3</sub> ,<br>t <sub>PLH3</sub> | T <sub>C</sub> = +25°C<br>C <sub>L</sub> = 50 pF<br>See figure 5            | 9                    |        | 240 | ns   |
|                                                    |                                          |                                                                             |                      |        | 48  |      |
|                                                    |                                          |                                                                             |                      |        | 41  |      |
|                                                    |                                          | T <sub>C</sub> = -55°C, +125°C<br>C <sub>L</sub> = 50 pF<br>See figure 5    | 10, 11               |        | 360 |      |
|                                                    |                                          |                                                                             |                      |        | 72  |      |
|                                                    |                                          |                                                                             |                      |        | 61  |      |
| Propagation delay<br>time, CLK to Qn<br>3/         | t <sub>PHL4</sub> ,<br>t <sub>PLH4</sub> | T <sub>C</sub> = +25°C<br>C <sub>L</sub> = 50 pF<br>See figure 5            | 9                    |        | 215 | ns   |
|                                                    |                                          |                                                                             |                      |        | 43  |      |
|                                                    |                                          |                                                                             |                      |        | 37  |      |
|                                                    |                                          | T <sub>C</sub> = -55°C, +125°C<br>C <sub>L</sub> = 50 pF<br>See figure 5    | 10, 11               |        | 325 |      |
|                                                    |                                          |                                                                             |                      |        | 65  |      |
|                                                    |                                          |                                                                             |                      |        | 55  |      |

See footnotes at end of table.

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TABLE I. Electrical performance characteristics - Continued.

| Test                                               | Symbol                                   | Conditions<br>-55°C < T <sub>C</sub> < +125°C<br>unless otherwise specified | Group A<br>subgroups | Limits |     | Unit |
|----------------------------------------------------|------------------------------------------|-----------------------------------------------------------------------------|----------------------|--------|-----|------|
|                                                    |                                          |                                                                             |                      | Min    | Max |      |
| Propagation delay<br>time, CLK to RC<br>3/         | t <sub>PHL5</sub> ,<br>t <sub>PLH5</sub> | T <sub>C</sub> = +25°C<br>C <sub>L</sub> = 50 pF<br>See figure 5            | 9                    |        | 125 | ns   |
|                                                    |                                          |                                                                             |                      |        | 25  |      |
|                                                    |                                          |                                                                             |                      |        | 21  |      |
|                                                    |                                          | T <sub>C</sub> = -55°C, +125°C<br>C <sub>L</sub> = 50 pF<br>See figure 5    | 10, 11               |        | 190 |      |
|                                                    |                                          |                                                                             |                      |        | 38  |      |
|                                                    |                                          |                                                                             |                      |        | 32  |      |
| Propagation delay<br>time, Down/Up to<br>RC<br>3/  | t <sub>PHL6</sub> ,<br>t <sub>PLH6</sub> | T <sub>C</sub> = +25°C<br>C <sub>L</sub> = 50 pF<br>See figure 5            | 9                    |        | 228 | ns   |
|                                                    |                                          |                                                                             |                      |        | 46  |      |
|                                                    |                                          |                                                                             |                      |        | 38  |      |
|                                                    |                                          | T <sub>C</sub> = -55°C, +125°C<br>C <sub>L</sub> = 50 pF<br>See figure 5    | 10, 11               |        | 342 |      |
|                                                    |                                          |                                                                             |                      |        | 68  |      |
|                                                    |                                          |                                                                             |                      |        | 59  |      |
| Propagation delay<br>time, CLK to<br>MAX/MIN<br>3/ | t <sub>PHL7</sub> ,<br>t <sub>PLH7</sub> | T <sub>C</sub> = +25°C<br>C <sub>L</sub> = 50 pF<br>See figure 5            | 9                    |        | 255 | ns   |
|                                                    |                                          |                                                                             |                      |        | 51  |      |
|                                                    |                                          |                                                                             |                      |        | 43  |      |

See footnotes at end of table.

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TABLE I. Electrical performance characteristics - Continued.

| Test                                                       | Symbol                                   | Conditions<br>-55°C < T <sub>C</sub> < +125°C<br>unless otherwise specified | Group A<br>subgroups | Limits |     | Unit |
|------------------------------------------------------------|------------------------------------------|-----------------------------------------------------------------------------|----------------------|--------|-----|------|
|                                                            |                                          |                                                                             |                      | Min    | Max |      |
| Propagation delay<br>time, CLK to<br>MAX/MIN <u>3/</u>     | t <sub>PHL7</sub> ,<br>t <sub>PLH7</sub> | T <sub>C</sub> = -55°C, +125°C<br>C <sub>L</sub> = 50 pF<br>See figure 5    | 10, 11               |        | 385 | ns   |
|                                                            |                                          |                                                                             |                      |        | 77  |      |
|                                                            |                                          |                                                                             |                      |        | 65  |      |
| Propagation delay<br>time, Down/Up to<br>MAX/MIN <u>3/</u> | t <sub>PHL8</sub> ,<br>t <sub>PLH8</sub> | T <sub>C</sub> = +25°C<br>C <sub>L</sub> = 50 pF<br>See figure 5            | 9                    |        | 190 | ns   |
|                                                            |                                          |                                                                             |                      |        | 38  |      |
|                                                            |                                          |                                                                             |                      |        | 32  |      |
|                                                            |                                          | T <sub>C</sub> = -55°C, +125°C<br>C <sub>L</sub> = 50 pF<br>See figure 5    | 10, 11               |        | 285 |      |
|                                                            |                                          |                                                                             |                      |        | 57  |      |
|                                                            |                                          |                                                                             |                      |        | 48  |      |
| Output transition<br>time, Qn, MAX/MIN,<br>RC <u>3/ 4/</u> | t <sub>THL1</sub> ,<br>t <sub>TLH1</sub> | T <sub>C</sub> = +25°C<br>C <sub>L</sub> = 50 pF<br>See figure 5            | 9                    |        | 75  | ns   |
|                                                            |                                          |                                                                             |                      |        | 15  |      |
|                                                            |                                          |                                                                             |                      |        | 13  |      |

See footnotes at end of table.

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TABLE I. Electrical performance characteristics - Continued.

| Test                                                              | Symbol                                 | Conditions<br>-55°C < T <sub>C</sub> < +125°C<br>unless otherwise specified | Group A<br>subgroups | Limits |     | Unit |
|-------------------------------------------------------------------|----------------------------------------|-----------------------------------------------------------------------------|----------------------|--------|-----|------|
|                                                                   |                                        |                                                                             |                      | Min    | Max |      |
| Output transition<br>time, Qn, MAX/MIN,<br>RC <u>3/</u> <u>4/</u> | t <sub>THL</sub> ,<br>t <sub>TLH</sub> | T <sub>C</sub> = -55°C, +125°C<br>C <sub>L</sub> = 50 pF<br>See figure 5    | 10, 11               |        | 110 | ns   |
|                                                                   |                                        |                                                                             |                      |        | 22  |      |
|                                                                   |                                        |                                                                             |                      |        | 19  |      |
| Maximum input<br>capacitance                                      | C <sub>IN</sub>                        | See 4.3.1c, V <sub>CC</sub> = GND                                           | 4                    |        | 10  | pF   |

1/ For a power supply of 5.0 V ±10%, the worst case output voltage (V<sub>OH</sub> and V<sub>OL</sub>) occur for HC at 4.5 V. Thus, the 4.5 V values should be used when designing with this supply. Worst case V<sub>IH</sub> and V<sub>IL</sub> occur at V<sub>CC</sub> = 5.5 V and 4.5 V respectively. (The V<sub>IH</sub> value at 5.5 V is 3.85 V). The worst case leakage current (I<sub>IN</sub>, I<sub>CC</sub>, and I<sub>OZ</sub>) occur for CMOS at the higher voltage so the 6.0 V values should be used. Power dissipation capacitance (C<sub>PD</sub>), typically 80 pF, determines the no load dynamic power consumption, P<sub>D</sub> = C<sub>PD</sub> V<sub>CC</sub><sup>2</sup> f + I<sub>CC</sub> V<sub>CC</sub>, and the no load dynamic current consumption, I<sub>S</sub> = C<sub>PD</sub> V<sub>CC</sub> f + I<sub>CC</sub>.

2/ V<sub>IH</sub> and V<sub>IL</sub> tests are not required if applied as forcing functions for the V<sub>OH</sub> and V<sub>OL</sub> tests.

3/ AC testing at V<sub>CC</sub> = 2.0 V and V<sub>CC</sub> = 6.0 V shall be guaranteed, if not tested, to the specified limit in table I.

4/ Transition times (t<sub>THL</sub>, t<sub>TLH</sub>), if not tested, shall be guaranteed to the specified limits in table I.

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|                 |                 |         |
|-----------------|-----------------|---------|
| Device type     | 01              |         |
| Case outlines   | E               | 2       |
| Terminal number | Terminal symbol |         |
| 1               | DB              | NC      |
| 2               | QB              | DB      |
| 3               | QA              | QB      |
| 4               | ENABLE          | QA      |
| 5               | DOWN/UP         | ENABLE  |
| 6               | QC              | NC      |
| 7               | QD              | DOWN/UP |
| 8               | GND             | QC      |
| 9               | DD              | QD      |
| 10              | DC              | GND     |
| 11              | LOAD            | NC      |
| 12              | MAX/MIN         | DD      |
| 13              | RC              | DC      |
| 14              | CLK             | LOAD    |
| 15              | DA              | MAX/MIN |
| 16              | VCC             | NC      |
| 17              | ---             | RC      |
| 18              | ---             | CLK     |
| 19              | ---             | DA      |
| 20              | ---             | VCC     |

NC = No connect

FIGURE 1. Terminal connections.

|                                                                                                     |                  |                |             |
|-----------------------------------------------------------------------------------------------------|------------------|----------------|-------------|
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Mode select table

| LOAD | ENABLE | DOWN/<br>UP | CLK                                                                               | FUNCTION   |
|------|--------|-------------|-----------------------------------------------------------------------------------|------------|
| H    | L      | L           |  | Count Up   |
| H    | L      | H           |  | Count Down |
| L    | X      | X           | X                                                                                 | Load       |
| H    | H      | X           | X                                                                                 | No change  |

RC truth table

| Inputs |         |    | Output |
|--------|---------|----|--------|
| ENABLE | MAX/MIN | CK | RC     |
| L      | H       | L  | L      |
| L      | L       | L  | H      |
| L      | H       | H  | H      |
| L      | L       | H  | H      |
| H      | L       | H  | H      |
| H      | L       | L  | H      |

H = High level

L = Low level

X = Irrelevant

 = Transition from low to high

Asynchronous inputs Low input to load sets QA = A,

QB = B, QC = C, QD = D

FIGURE 2. Truth tables.

|                                                                                                     |                  |                |             |
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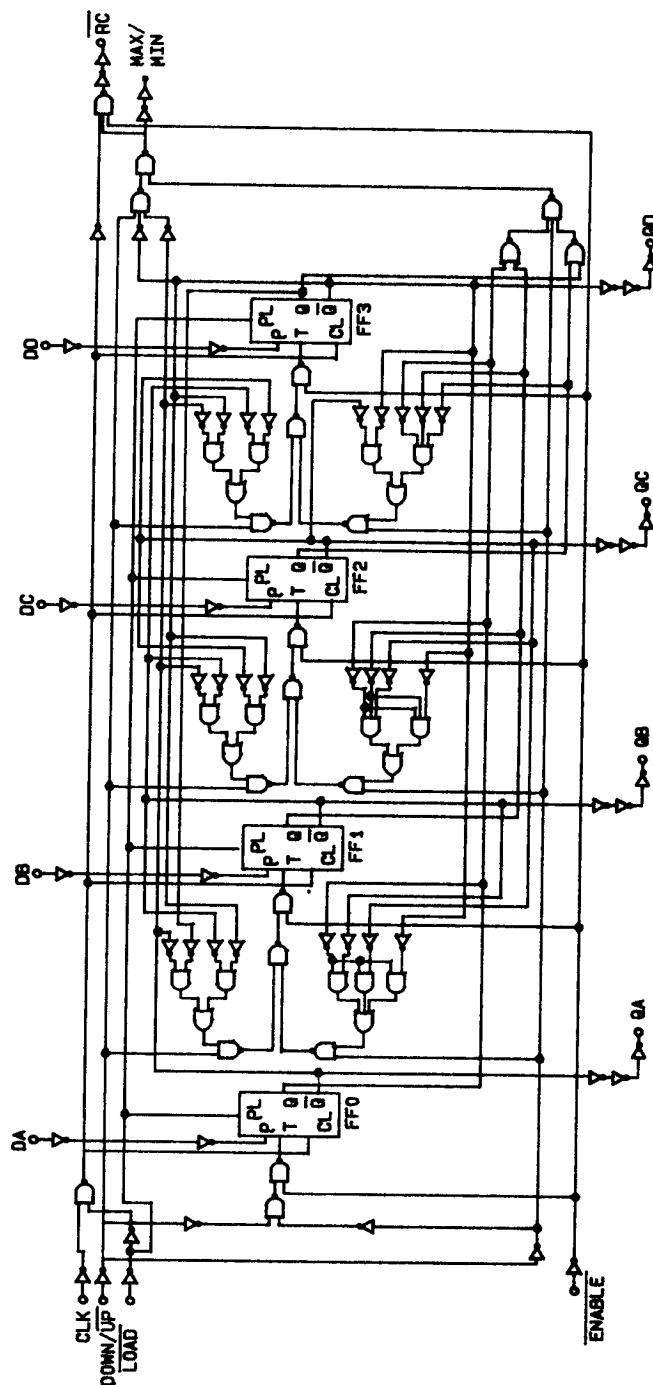


FIGURE 3. Logic diagram.

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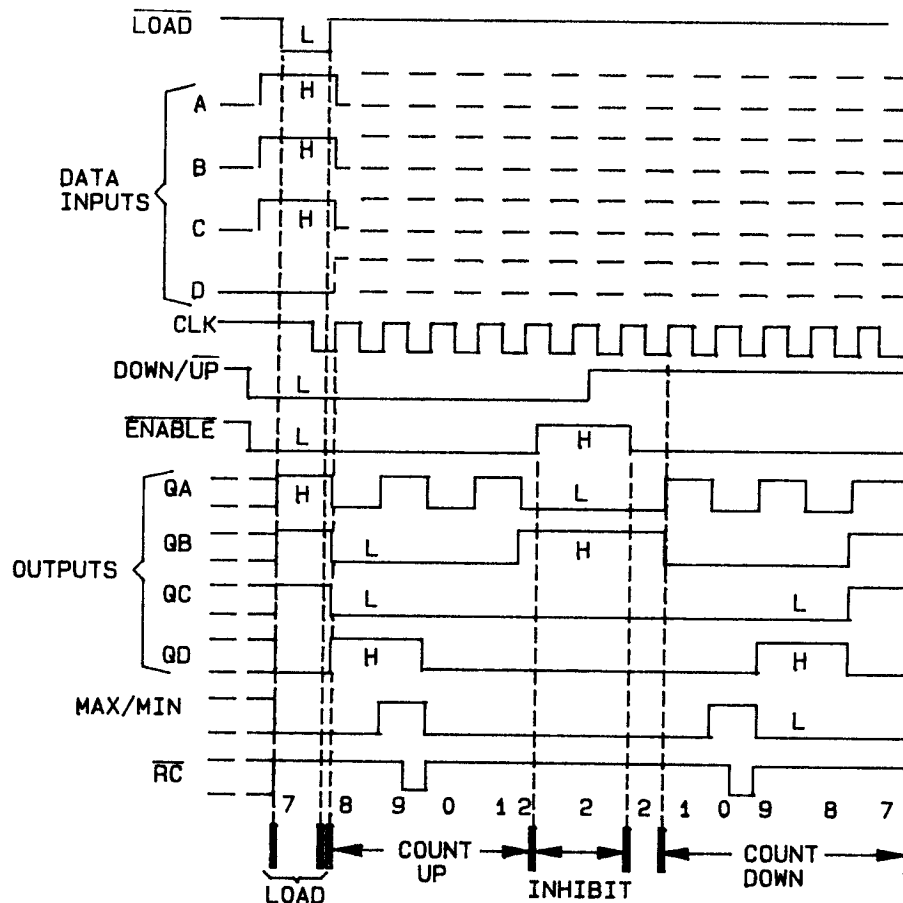
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Sequence:

- (1) Load (preset) to BCD seven
- (2) Count up to eight, nine, zero, one, and two
- (3) Inhibit
- (4) Count down to one, zero, nine, eight, and seven

FIGURE 4. Counting sequence diagram.

|                                                                                                     |                  |                |             |
|-----------------------------------------------------------------------------------------------------|------------------|----------------|-------------|
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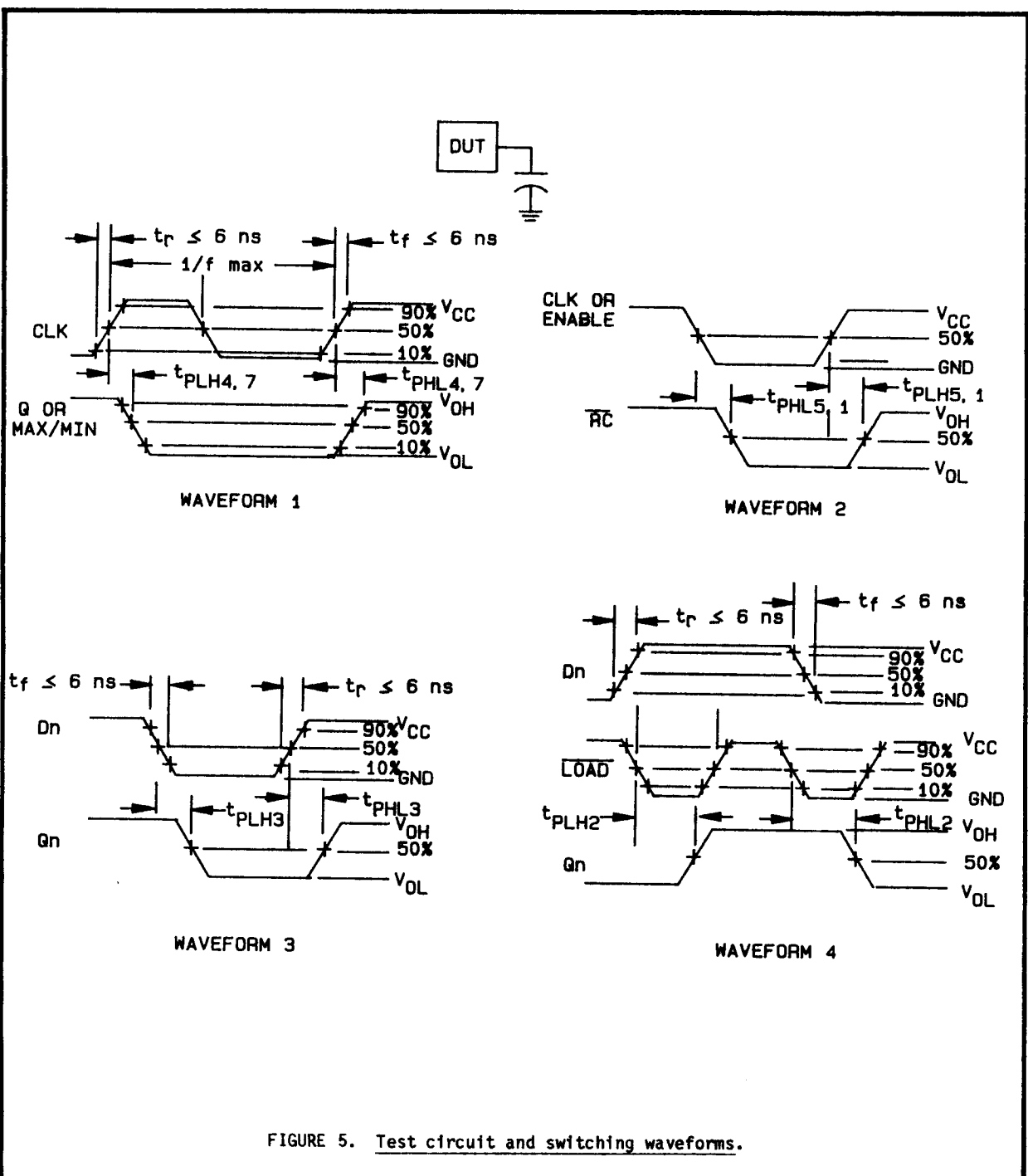


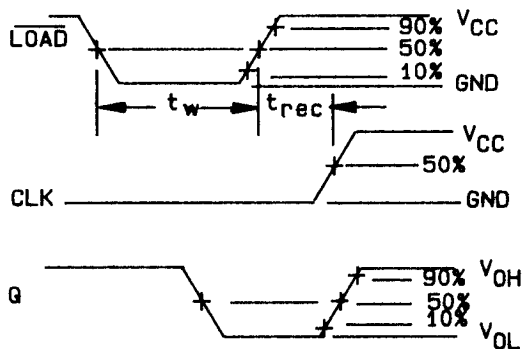
FIGURE 5. Test circuit and switching waveforms.

|                                                                                                     |                  |                |             |
|-----------------------------------------------------------------------------------------------------|------------------|----------------|-------------|
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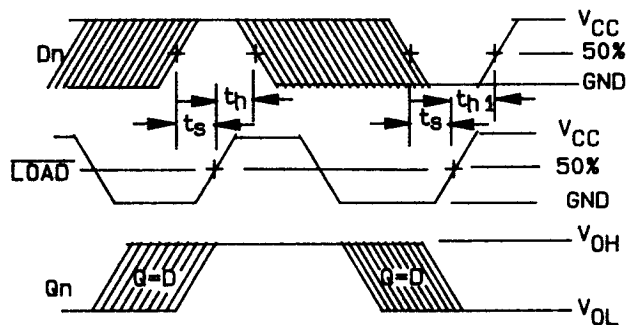
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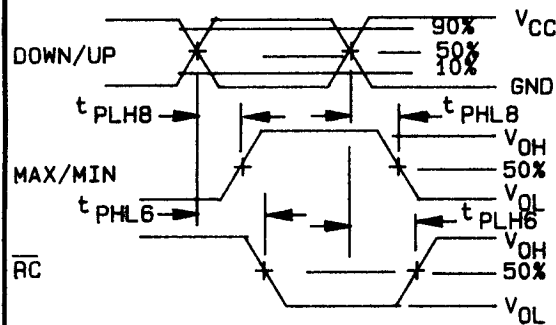




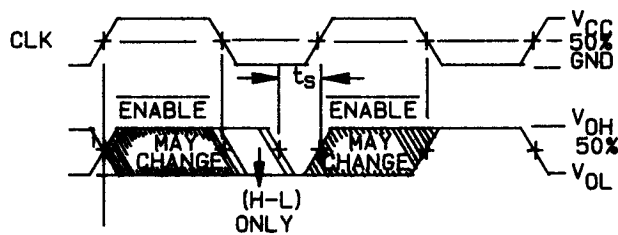
WAVEFORM 5



WAVEFORM 6



WAVEFORM 7



WAVEFORM 8

The shaded area indicate when the input is permitted to change for predictable output performance.

FIGURE 5. Test circuit and switching waveforms - Continued.

|                                                                                                     |                  |                |             |
|-----------------------------------------------------------------------------------------------------|------------------|----------------|-------------|
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3.5 Marking. Marking shall be in accordance with MIL-STD-883 (see 3.1 herein). The part shall be marked with the part number listed in 1.2 herein. In addition, the manufacturer's part number may also be marked as listed in MIL-BUL-103 (see 6.6 herein).

3.6 Certificate of compliance. A certificate of compliance shall be required from a manufacturer in order to be listed as an approved source of supply in MIL-BUL-103 (see 6.6 herein). The certificate of compliance submitted to DESC-ECS prior to listing as an approved source of supply shall affirm that the manufacturer's product meets the requirements of MIL-STD-883 (see 3.1 herein) and the requirements herein.

3.7 Certificate of conformance. A certificate of conformance as required in MIL-STD-883 (see 3.1 herein) shall be provided with each lot of microcircuits delivered to this drawing.

3.8 Notification of change. Notification of change to DESC-ECS shall be required in accordance with MIL-STD-883 (see 3.1 herein).

3.9 Verification and review. DESC, DESC's agent, and the acquiring activity retain the option to review the manufacturer's facility and applicable required documentation. Offshore documentation shall be made available onshore at the option of the reviewer.

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Sampling and inspection. Sampling and inspection procedures shall be in accordance with section 4 of MIL-M-38510 to the extent specified in MIL-STD-883 (see 3.1 herein).

4.2 Screening. Screening shall be in accordance with method 5004 of MIL-STD-883, and shall be conducted on all devices prior to quality conformance inspection. The following additional criteria shall apply:

a. Burn-in test, method 1015 of MIL-STD-883.

(1) Test condition A, B, C, or D using the circuit submitted with the certificate of compliance (see 3.6 herein).

(2)  $T_A = +125^{\circ}\text{C}$ , minimum.

b. Interim and final electrical test parameters shall be as specified in table II herein, except interim electrical parameter tests prior to burn-in are optional at the discretion of the manufacturer.

4.3 Quality conformance inspection. Quality conformance inspection shall be in accordance with method 5005 of MIL-STD-883 including groups A, B, C, and D inspections. The following additional criteria shall apply.

##### 4.3.1 Group A inspection.

a. Tests shall be as specified in table II herein.

b. Subgroups 5 and 6 in table I, method 5005 of MIL-STD-883 shall be omitted.

c. Subgroup 4 ( $C_{in}$  measurement) shall be measured only for the initial test and after process or design changes which may affect capacitance. Capacitance shall be measured between the designated terminal and GND at a frequency of 1 MHz. Test all applicable pins on five devices with zero failures.

d. Subgroups 7 and 8 tests shall verify the truth table as specified on figure 2.

|                                                                                                     |                  |                |             |
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TABLE II. Electrical test requirements.

| MIL-STD-883 test requirements                                      | Subgroups<br>(per method<br>5005, table I) |
|--------------------------------------------------------------------|--------------------------------------------|
| Interim electrical parameters<br>(method 5004)                     | ---                                        |
| Final electrical test parameters<br>(method 5004)                  | 1*, 2, 3, 7,<br>8, 9                       |
| Group A test requirements<br>(method 5005)                         | 1, 2, 3, 4, 7,<br>8, 9, 10**, 11**         |
| Groups C and D end-point<br>electrical parameters<br>(method 5005) | 1, 2, 3                                    |

\* PDA applies to subgroup 1.

\*\* Subgroups 10 and 11, if not tested, shall be guaranteed to the specified limits in table I.

#### 4.3.2 Groups C and D inspections.

- a. End-point electrical parameters shall be as specified in table II herein.
- b. Steady-state life test conditions, method 1005 of MIL-STD-883.
  - (1) Test condition A, B, C, or D using the circuit submitted with the certificate of compliance (see 3.6 herein).
  - (2)  $T_A = +125^\circ\text{C}$ , minimum.
  - (3) Test duration: 1,000 hours, except as permitted by method 1005 of MIL-STD-883.

#### 5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-M-38510.

#### 6. NOTES

6.1 Intended use. Microcircuits conforming to this drawing are intended for use when military specifications do not exist and qualified military devices that will perform the required function are not available for OEM application. When a military specification exists and the product covered by this drawing has been qualified for listing on QPL-38510, the device specified herein will be inactivated and will not be used for new design. The QPL-38510 product shall be the preferred item for all applications.

6.2 Replaceability. Microcircuits covered by this drawing will replace the same generic device covered by a contractor-prepared specification or drawing.

6.3 Configuration control of SMD's. All proposed changes to existing SMD's will be coordinated with the users of record for the individual documents. This coordination will be accomplished in accordance with MIL-STD-481 using DD Form 1693, Engineering Change Proposal (Short Form).

|                                                                                                     |                  |                |             |
|-----------------------------------------------------------------------------------------------------|------------------|----------------|-------------|
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6.4 Record of users. Military and industrial users shall inform Defense Electronics Supply Center when a system application requires configuration control and the applicable SMD. DESC will maintain a record of users and this list will be used for coordination and distribution of changes to the drawings. Users of drawings covering microelectronics devices (FSC 5962) should contact DESC-ECS, telephone (513) 296-6022.

6.5 Comments. Comments on this drawing should be directed to DESC-ECS, Dayton, Ohio 45444, or telephone (513) 296-8525.

6.6 Approved sources of supply. Approved sources of supply are listed in MIL-BUL-103. Additional sources will be added to MIL-BUL-103 as they become available. The vendors listed in MIL-BUL-103 have agreed to this drawing and a certificate of compliance (see 3.6 herein) has been submitted to and accepted by DESC-ECS. The approved sources listed below are for information purposes only and are current only to the date of the last action of this document.

| Military drawing<br>part number | Vendor<br>CAGE<br>number | Vendor<br>similar part<br>number <sup>1/</sup> |
|---------------------------------|--------------------------|------------------------------------------------|
| 5962-8994601EX                  | 01295<br>34371           | SNJ54HC190J<br>CD54HC190F/3A                   |
| 5962-89946012X                  | 01295                    | SNJ54HC190FK                                   |

<sup>1/</sup> Caution. Do not use this number for item acquisition. Items acquired to this number may not satisfy the performance requirements of this drawing.

Vendor CAGE  
number

01295

34371

Vendor name  
and address

Texas Instruments Incorporated  
13500 N. Central Expressway  
PO Box 655303  
Dallas, TX 75265  
Point of contact: I-20 at FM 1788  
Midland, TX 79711-0448

Harris Semiconductor  
2401 Palm Bay Road  
PO Box 883  
Melbourne, FL 32901

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