REVISIONS			
LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED

REV																		
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REV STATUS OF SHEETS	REV																	
	SHEET	1	2	3	4	5	6	7	8	9	10	11	12	13	14			

PMIC N/A

STANDARDIZED MILITARY DRAWING

THIS DRAWING IS AVAILABLE FOR USE BY ALL DEPARTMENTS AND AGENCIES OF THE DEPARTMENT OF DEFENSE

AMSC N/A

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DRAWING APPROVAL DATE
93-03-05

REVISION LEVEL

DEFENSE ELECTRONICS SUPPLY CENTER
DAYTON, OHIO 45444

MICROCIRCUITS, DIGITAL, ADVANCED HIGH-SPEED CMOS, OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOP WITH TRI-STATE OUTPUTS, TTL COMPATIBLE INPUTS, MONOLITHIC SILICON

SIZE A	CAGE CODE 67268	5962-89742	
SHEET	1	OF 14	1

5962-E688-92

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 or Identifying Number (PIN). The complete PIN shall be as shown in the following example:

```
5962-89742                01                    R                      X
    |                     |                     |                      |
 _____              _____              _____            _____
Drawing number       Device type          Case outline            Lead finish
                     (see 1.2.1)           (see 1.2.2)             (see 1.2.3)
```

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

Device type	Generic number	Circuit function
01	54HCT574	Octal D-type edge-triggered flip-flop, three-state outputs, TTL compatible inputs

1.2.2 Case outline(s). The case outline(s) shall be as designated in MIL-STD-1835 and as follows:

Outline letter	Descriptive designator	Terminals	Package style
R	GDIP1-T20 or CDIP2-T20	20	Dual-in-line
2	CQCC1-N20	20	Square leadless chip carrier

1.2.3 Lead finish. The lead finish shall be as specified in MIL-M-38510. Finish letter "X" shall not be marked on the microcircuit or its packaging. The "X" designation is for use in specifications when lead finishes A, B, and C are considered acceptable and interchangeable without preference.

1.3 Absolute maximum ratings. 1/ 2/ 3/

Supply voltage range (V_{CC})	-0.5 V dc to +7.0 V dc
DC input voltage (V_{IN})	-0.5 V dc to V_{CC} +0.5 V dc
DC output voltage (V_{OUT})	-0.5 V dc to V_{CC} +0.5 V dc
Input clamp current (I_{IK}) ($V_{IN} < 0.0$ V, $V_{IN} > V_{CC}$)	±20 mA
Output clamp current (I_{OK}) ($V_{OUT} < 0.0$ V, $V_{OUT} > V_{CC}$)	±20 mA
DC output current (I_{OUT}) ($V_{OUT} = 0$ to V_{CC}) (per output)	±35 mA
DC V_{CC} or GND current (I_{CC} or I_{GND}) (per pin)	±70 mA
Storage temperature range	-65°C to +150°C
Maximum power dissipation (P_D)	500 mW 4/
Lead temperature (soldering, 10 seconds)	+265°C
Thermal resistance, junction-to-case (θ_{JC})	See MIL-STD-1835
Junction temperature (T_J)	+175°C
Case operating temperature (T_C)	-55°C to +125°C

1/ Stresses above the absolute maximum rating may cause permanent damage to the device. Extended operation at the maximum levels may degrade performance and affect reliability.
2/ Unless otherwise specified, all voltages are referenced to ground.
3/ The limits for the parameters specified herein shall apply over the full specified V_{CC} range and case temperature range of -55°C to +125°C.
4/ For $T_C = +100°C$ to +125°C, derate linearly at 8 mW/°C.

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1.4 <u>Recommended operating conditions</u>. 1/ 2/

Supply voltage (V_{CC}) -	+4.5 V dc to +5.5 V dc
Input voltage range (V_{IN}) -	0.0 V dc to V_{CC}
Output voltage range (V_{OUT}) -	0.0 V dc to V_{CC}
Case operating temperature range (T_C) - - - - - - - - - - - - - - - - - - -	-55°C to +125°C
Input rise or fall (t_r, t_f) time ($0.1V_{CC}$ to $0.9V_{CC}$, $0.9V_{CC}$ to $0.1V_{CC}$) - - - -	0 to 500 ns
Minimum high level input voltage (V_{IH}) - - - - - - - - - - - - - - - - - - -	2.0 V dc
Maximum low level input voltage (V_{IL}) - - - - - - - - - - - - - - - - - - -	0.8 V dc
Maximum high level output current (I_{OH}) - - - - - - - - - - - - - - - - - -	-6 mA
Maximum low level output current (I_{OL}) - - - - - - - - - - - - - - - - - - -	+6 mA

2. APPLICABLE DOCUMENTS

2.1 <u>Government specification, standards, and bulletin</u>. Unless otherwise specified, the following specification, standards, 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.

STANDARDS

MILITARY

MIL-STD-883 - Test Methods and Procedures for Microelectronics.
MIL-STD-1835 - Microcircuit Case Outlines.

BULLETIN

MILITARY

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

(Copies of the specification, standards, 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 <u>Non-Government publications</u>. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation.

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)

JEDEC Standard No. 7-A - Standardized for Description of 54/74HCXXXX and 54/74HCTXXXX High-Speed
                        CMOS Devices.

(Applications for copies should be addressed to the Electronics Industries Association, 2001 Eye Street, NW, Washington, DC 20006.)

2.3 <u>Order of precedence</u>. 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.

1/ Unless otherwise specified, all voltages are referenced to ground.
2/ The limits for the parameters specified herein shall apply over the full specified V_{CC} range and case temperature range of -55°C to +125°C.

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3. REQUIREMENTS

3.1 <u>Item requirements</u>. 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 <u>Design, construction, and physical dimensions</u>. The design, construction, and physical dimensions shall be as specified in MIL-M-38510 and herein.

3.2.1 <u>Case outline(s)</u>. The case outline(s) shall be in accordance with 1.2.2 herein.

3.2.2 <u>Terminal connections</u>. The terminal connections shall be as specified on figure 1.

3.2.3 <u>Truth table</u>. The truth table shall be as specified on figure 2.

3.2.4 <u>Logic diagram</u>. The logic diagram shall be as specified on figure 3.

3.2.5 <u>Switching waveforms</u>. The switching waveforms shall be as specified on figure 4.

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

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

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

3.6 <u>Certificate of compliance</u>. 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-EC 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 <u>Certificate of conformance</u>. 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 <u>Notification of change</u>. Notification of change to DESC-EC shall be required in accordance with MIL-STD-883 (see 3.1 herein).

3.9 <u>Verification and review</u>. 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.

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TABLE I. Electrical performance characteristics.

Test and MIL-STD-883 test method	Symbol	Conditions -55°C ≤ T_C ≤ +125°C 4.5 V ≤ V_{CC} ≤ 5.5 V unless otherwise specified	Device type	V_{CC}	Group A subgroups	Limits		Unit
						Min	Max	
High level output voltage 3006	V_{OH1} 1/	For all inputs affecting output under test $V_{IN} = V_{IH}$ or V_{IL} $V_{IH} = 2.0$ V $V_{IL} = 0.8$ V For all other inputs $V_{IN} = V_{CC}$ or GND $I_{OH} = -20$ µA	All	4.5 V	1,2,3	4.4		V
	V_{OH2} 1/	For all inputs affecting output under test $V_{IN} = V_{IH}$ or V_{IL} $V_{IH} = 2.0$ V $V_{IL} = 0.8$ V For all other inputs $V_{IN} = V_{CC}$ or GND $I_{OH} = -6.0$ mA	All	4.5 V	1	3.98		V
					2,3	3.7		
Low level output voltage 3007	V_{OL1} 1/	For all inputs affecting output under test $V_{IN} = V_{IH}$ or V_{IL} $V_{IH} = 2.0$ V $V_{IL} = 0.8$ V For all other inputs $V_{IN} = V_{CC}$ or GND $I_{OL} = 20$ µA	All	4.5 V	1,2,3		0.1	V
	V_{OL2} 1/	For all inputs affecting output under test $V_{IN} = V_{IH}$ or V_{IL} $V_{IH} = 2.0$ V $V_{IL} = 0.8$ V For all other inputs $V_{IN} = V_{CC}$ or GND $I_{OL} = 6.0$ mA	All	4.5 V	1		0.26	V
					2,3		0.4	
Input current low 3009	I_{IL}	For input under test $V_{IN} = $ GND For all other inputs $V_{IN} = V_{CC}$ or GND	All	5.5 V	1		-0.1	µA
					2,3		-1.0	
Input current high 3010	I_{IH}	For input under test $V_{IN} = V_{CC}$ For all other inputs $V_{IN} = V_{CC}$ or GND	All	5.5 V	1		0.1	µA
					2,3		1.0	

See footnotes at end of table.

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TABLE I. Electrical performance characteristics - Continued.

Test and MIL-STD-883 test method	Symbol	Conditions -55°C ≤ T_C ≤ +125°C 4.5 V ≤ V_{CC} ≤ 5.5 V unless otherwise specified	Device type	V_{CC}	Group A subgroups	Limits Min	Limits Max	Unit
Quiescent supply current output three-stated 3005	I_{CCZ}	$\overline{OC}$ = GND For all other inputs V_{IN} = V_{CC} or GND	All	5.5 V	1		8	μA
					2,3		160	
Quiescent supply current output high 3005	I_{CCH}	For all inputs V_{IN} = V_{CC} or GND	All	5.5 V	1		8	μA
					2,3		160	
Quiescent supply current output low 3005	I_{CCL}	For all inputs V_{IN} = V_{CC} or GND	All	5.5 V	1		8	μA
					2,3		160	
Additional quiescent supply current	ΔI_{CC} 2/	For input under test V_{IN} = 2.4 V, 0.5 V For all other inputs V_{IN} = V_{CC} or GND	All	5.5 V	1		2.4	mA
					2,3		3.0	
Three-state output leakage current low 3020	I_{OZL}	$\overline{OC}$ = 0.8 V or 2.0 V For all other inputs V_{IN} = V_{CC} or GND For output under test V_{OUT} = GND	All	5.5 V	1		-0.5	μA
					2,3		-10.0	
Three-state output leakage current high 3021	I_{OZH}	$\overline{OC}$ = 0.8 V or 2.0 V For all other inputs V_{IN} = V_{CC} or GND For output under test V_{OUT} = V_{CC}	All	5.5 V	1		0.5	μA
					2,3		10.0	
Input capacitance 3012	C_{IN}	T_C = +25°C See 4.3.1c	All	GND	4		10	pF
Output three-state capacitance 3012	C_{OUT}	T_C = +25°C See 4.3.1c	All	5.5 V	4		20	pF
Power dissipation capacitance	C_{PD} 3/	T_C = +25°C See 4.3.1c	All	5.0 V	4		93	pF
Functional tests 3014		See 4.3.1d	All		7,8			

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

Test and MIL-STD-883 test method	Symbol	Conditions -55°C ≤ T_C ≤ +125°C 4.5 V ≤ V_{CC} ≤ 5.5 V unless otherwise specified	Device type	V_{CC}	Group A subgroups	Limits Min	Limits Max	Unit
Maximum clock frequency 3003	f_{MAX} 2/	C_L = 50 pF minimum See figure 4	All	4.5 V	9	30		MHz
					10,11	20		
Minimum high, low clock pulse width	t_w 2/		All	4.5 V	9		16	ns
					10,11		24	
Minimum high, low setup time, nD to CLK↓	t_{su} 2/		All	4.5 V	9		12	ns
					10,11		18	
Minimum high, low hold time, nD from CLK↓	t_h 2/		All	4.5 V	9,10,11		5	ns
Propagation delay time CLK to nQ 3003	t_{PLH}, t_{PHL}		All	4.5 V	9		33	ns
					10,11		50	
Output enable time OC to nQ 3003	t_{PZL}, t_{PZH}	C_L = 50 pF minimum R_L = 1 KΩ See figure 4	All	4.5 V	9		30	ns
					10,11		45	
Output disable time OC to nQ 3003	t_{PLZ}, t_{PHZ}		All	4.5 V	9		28	ns
					10,11		42	
Output transition time nQ 3003	t_{TLH}, t_{THL} 2/	C_L = 50 pF minimum See figure 4	All	4.5 V	9		12	ns
					10,11		18	

1/ For a power supply of 5 V ±10% the worst case output voltages (V_{OH} and V_{OL}) occur for HCT at 4.5 V. Thus, the 4.5 V values should be used when designing with this supply. Worst cases V_{IH} and V_{IL} occur at V_{CC} = 5.5 V and 4.5 V respectively.

2/ Guaranteed, if not tested, to the limits specified in table I.

3/ Power dissipation capacitance (C_{PD}), determines the no load dynamic power consumption; P_D (total) = $C_{PD}V_{CC}^2f$ + (V_{CC} x I_{CC}) + n (ΔI_{CC} x V_{CC} x d), and the no load dynamic current consumption (I_S) is I_S = $C_{PD}V_{CC}f$ + I_{CC} + ndΔI_{CC}.
Where: P_D = dynamic power dissipation.
   C_{PD}= power dissipation capacitance of the device
   f = input switching frequency
   n = number of inputs switching
   d = duty cycle

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Device type		01	
Case outlines		R,2	
Terminal number	Terminal symbol	Terminal number	Terminal symbol
1	$\overline{OC}$	11	CLK
2	1D	12	8Q
3	2D	13	7Q
4	3D	14	6Q
5	4D	15	5Q
6	5D	16	4Q
7	6D	17	3Q
8	7D	18	2Q
9	8D	19	1Q
10	GND	20	V_{CC}

Terminal symbol descriptions	
Terminal symbol	Description
nD (n = 1 to 8)	Data inputs
$\overline{OC}$	Output enable control input (active low)
nQ (n = 1 to 8)	Outputs (non-inverting)
CLK	Clock pulse timing input (active rising edge)

FIGURE 1. Terminal connections.

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Inputs			Output Q
$\overline{OC}$	CLK	D	
L	↑	H	H
L	↑	L	L
L	L	X	Q_0
H	X	X	Z

H = High voltage level
L = Low voltage level
X = Immaterial
Z = High-impedance
↑ = Low-to-high transition
Q_0 = Previous mQ before low-to-high transition of CLK
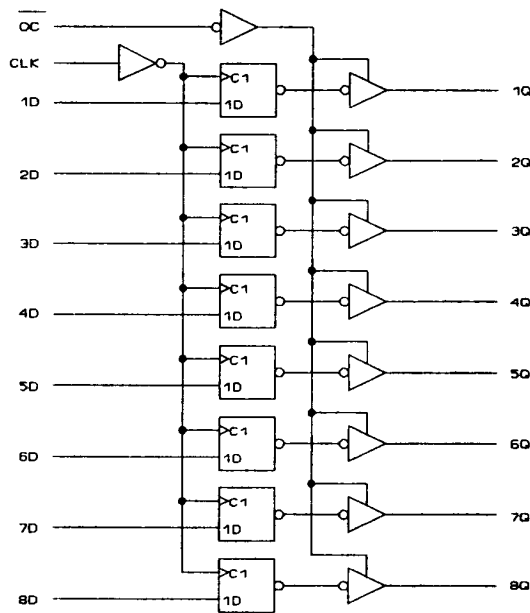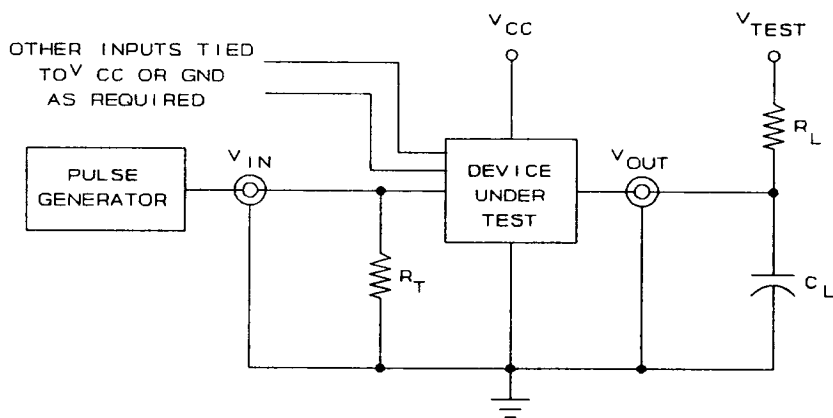
FIGURE 2. Truth table.

FIGURE 3. Logic diagram.

OTHER INPUTS TIED
TO V_{CC} OR GND
AS REQUIRED

V_{CC}

V_{TEST}

PULSE
GENERATOR

V_{IN}

DEVICE
UNDER
TEST

V_{OUT}

R_L

R_T

C_L

NOTES:
When measuring t_{PHZ} and t_{PZH}: V_{test} = GND
When measuring t_{PLZ} and t_{PZL}: V_{test} = V_{CC}
When measuring t_{PLH} and t_{PHL}: V_{test} = open
The t_{PZL} and t_{PLZ} reference waveform is for the output under test with internal conditions such that the output is at V_{OL} except when disabled by the output enable control. The t_{PZH} and t_{PHZ} reference waveform is for the output under test with internal conditions such that the output is at V_{OH} except when disabled by the output enable control.

C_L = 50 pF minimum or equivalent (includes probe and jig capacitance)
R_L = 1 KΩ or equivalent
R_T = 50 Ω or equivalent
Input signal from pulse generator: V_{IN} = 0.0 V to 3.0 V; $t_r \leq$ 6 ns; $t_f \leq$ 6 ns; duty cycle = 50 percent.
Timing parameters shall be tested at a minimum input frequency of 1 MHz.
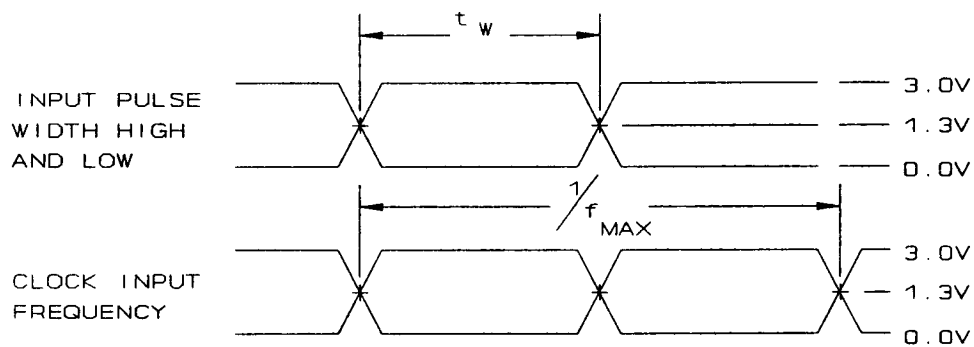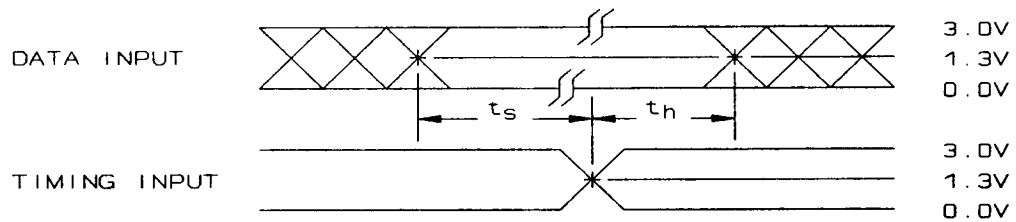The outputs are measured one at a time with one transition per measurement.

FIGURE 4. Switching waveforms and test circuit.

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DATA INPUT

```
                                  3.0V
                                  1.3V
                                  0.0V
        |←─ tS ─→|←─ th ─→|
```

TIMING INPUT

```
                                  3.0V
                                  1.3V
                                  0.0V
```

```
        |←── t W ──→|
```

INPUT PULSE
WIDTH HIGH
AND LOW

```
                                  3.0V
                                  1.3V
                                  0.0V
```

```
        |←────── 1/f MAX ──────→|
```

CLOCK INPUT
FREQUENCY

```
                                  3.0V
                                  1.3V
                                  0.0V
```
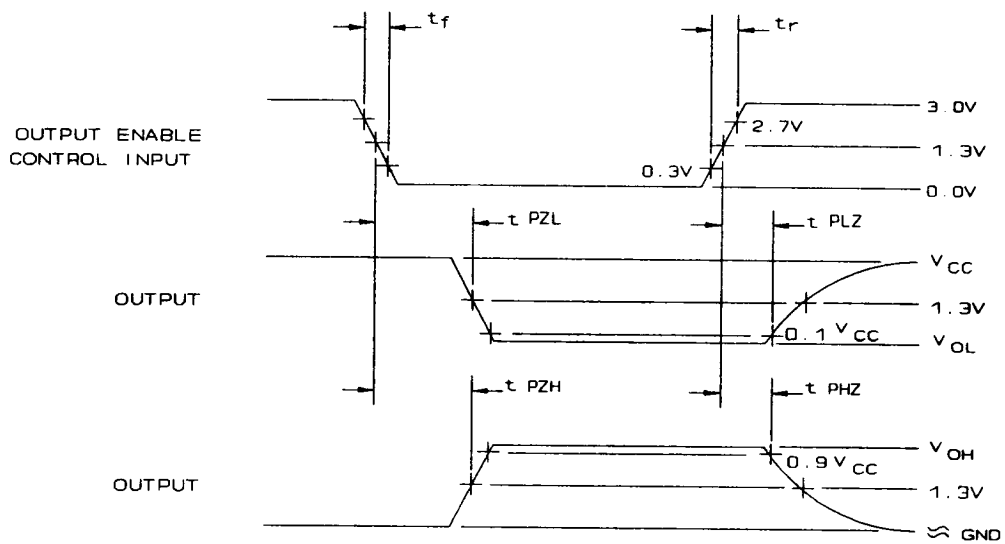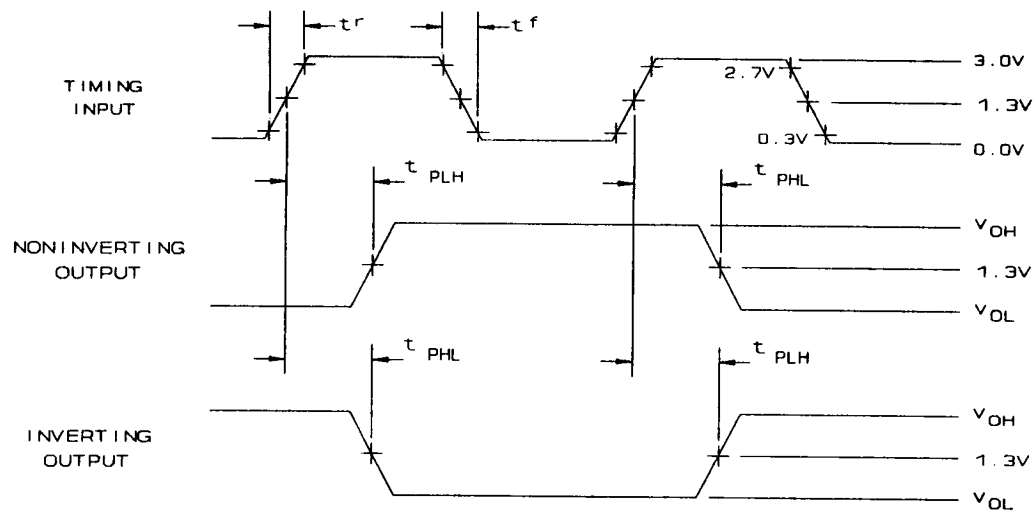
FIGURE 4. Switching waveforms and test circuit - Continued.

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FIGURE 4. Switching waveforms and test circuit - Continued.

4. QUALITY ASSURANCE PROVISIONS

4.1 <u>Sampling and inspection</u>. 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 <u>Screening</u>. 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. The test circuit shall be maintained by the manufacturer under document revision level control and shall be made available to the preparing or acquiring activity upon request. The test circuit shall specify the inputs, outputs, biases, and power dissipation, as applicable, in accordance with the intent specified in test method 1015 of MIL-STD-883.

        (2) T_A = +125°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.

<div align="center">TABLE II. <u>Electrical test requirements</u>.</div>

Test requirements	Subgroups (in accordance with method 5005, table I)
Interim electrical parameters (method 5004)	
Final electrical parameters (method 5004)	1*,2,3 7,8,9,10,11
Group A test requirements (method 5005)	1,2,3,4,7, 8,9,10,11
Group C and D end-point electrical parameters (method 5005)	1,2,3

    * PDA applies to subgroup 1.

4.3 <u>Quality conformance inspection</u>. 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 <u>Group A inspection</u>.

    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. C_{IN}, C_{OUT}, and C_{PD} shall be measured only for initial qualification and after process or design changes which may affect capacitance. C_{IN} and C_{OUT} shall be measured between the designated terminal and GND at a frequency of 1 MHz. C_{PD} shall be tested in accordance with the latest revision of JEDEC Standard No. 7-A and table I herein. For C_{IN}, C_{OUT}, and C_{PD}, test all applicable pins on five devices with zero failures.

    d. Subgroups 7 and 8 tests shall be sufficient to verify the truth table in figure 2 herein. The test vectors used to verify the truth table shall, at a minimum, test all functions of each input and output. All possible input to output logic patterns per function shall be guaranteed, if not tested, to the truth tables in figure 2 herein.

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4.3.2 <u>Groups C and D inspections</u>.

   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. The test circuit shall be maintained by the manufacturer under document revision level control and shall be made available to the preparing or acquiring activity upon request. The test circuit shall specify the inputs, outputs, biases, and power dissipation, as applicable, in accordance with the intent specified in test method 1005 of MIL-STD-883.

     (2) T_A = +125°C, minimum.

     (3) Test duration: 1,000 hours, except as permitted by method 1005 of MIL-STD-883.

4.4 <u>Methods of inspection</u>. Methods of inspection shall be specified as follows:

4.4.1 <u>Voltage and current</u>. Unless otherwise specified, all voltages given are referenced to the microcircuit GND terminal. Currents given are conventional current and positive when flowing into the referenced terminal.

5. PACKAGING

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

6. NOTES

6.1 <u>Intended use</u>. 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 original equipment manufacturer 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 <u>Replaceability</u>. Microcircuits covered by this drawing will replace the same generic device covered by a contractor-prepared specification or drawing.

6.3 <u>Configuration control of SMD's</u>. 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).

6.4 <u>Record of users</u>. 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-EC, telephone (513) 296-6047.

6.5 <u>Comments</u>. Comments on this drawing should be directed to DESC-EC, Dayton, Ohio 45444, or telephone (513) 296-5377.

6.6 <u>Approved sources of supply</u>. Approved sources of supply are listed in MIL-BUL-103. 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-EC.

STANDARDIZED MILITARY DRAWING DEFENSE ELECTRONICS SUPPLY CENTER DAYTON, OHIO 45444	SIZE A		5962-89742
		REVISION LEVEL	SHEET 14

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