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	SHEET	1	2	3	4	5	6	7	8	9	10	11	12	13

PMIC N/A	PREPARED BY <i>Marcia B Kelleher</i>	DEFENSE ELECTRONICS SUPPLY CENTER DAYTON, OHIO 45444	
STANDARDIZED MILITARY DRAWING THIS DRAWING IS AVAILABLE FOR USE BY ALL DEPARTMENTS AND AGENCIES OF THE DEPARTMENT OF DEFENSE	CHECKED BY <i>Ray Monnin</i>	MICROCIRCUITS, DIGITAL, HIGH-SPEED CMOS, BCD DECADE COUNTER, SYNCHRONOUS RESET, MONOLITHIC SILICON	
	APPROVED BY 		
	DRAWING APPROVAL DATE 01 AUGUST 1989	SIZE A	CAGE CODE 67268
AMSC N/A	REVISION LEVEL	SHEET 1	

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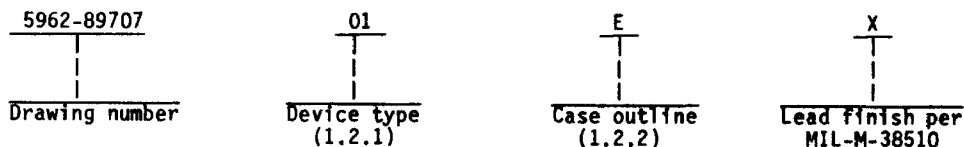
• U.S. GOVERNMENT PRINTING OFFICE: 1987 — 748-129/60911
5962-E1355-5

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

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:



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

<u>Device type</u>	<u>Generic number</u>	<u>Circuit function</u>
01	54HCT162	BCD decade counter, synchronous reset, TTL compatible inputs

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

<u>Outline letter</u>	<u>Case outline</u>
E	D-2 (16-lead, .840" x .310" x .200"), dual-in-line package

1.3 Absolute maximum ratings. 1/

Supply voltage range - - - - -	-0.5 V dc to +7.0 V dc
DC input voltage - - - - -	-0.5 V dc to $V_{CC} + 0.5$ V dc
DC output voltage - - - - -	-0.5 V dc to $V_{CC} + 0.5$ V dc
Clamp diode current - - - - -	*20 mA
DC output current (per pin) - - - - -	*20 mA
DC drain current (per pin) - - - - -	*25 mA
DC V_{CC} or GND current - - - - -	*50 mA
Storage temperature range - - - - -	-65°C to +150°C
Maximum power dissipation (P_D) - - - - -	500 mW 2/
Lead temperature (soldering, 10 seconds) - - - - -	+300°C
Thermal resistance, junction-to-case (θ_{JC}) - - - - -	See MIL-M-38510, appendix C
Junction temperature (T_J) - - - - -	+175°C

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 8 mW/°C.

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1.4 Recommended operating conditions.

Supply voltage (V_{CC}) - - - - -	+4.5 V dc to +5.5 V dc
Case operating temperature (T_C) - - - - -	-55°C to +125°C
Input rise or fall time: $V_{CC} = 4.5$ V - - - - -	0 to 500 ns
Minimum setup time, Pn to CP (t_{s1}):	
$T_C = +25^\circ\text{C}$, $V_{CC} = 4.5$ V - - - - -	10 ns
$T_C = -55^\circ\text{C}/+125^\circ\text{C}$, $V_{CC} = 4.5$ V - - - - -	15 ns
Minimum setup time, PE or TE to CP (t_{s2}):	
$T_C = +25^\circ\text{C}$, $V_{CC} = 4.5$ V - - - - -	13 ns
$T_C = -55^\circ\text{C}/+125^\circ\text{C}$, $V_{CC} = 4.5$ V - - - - -	20 ns
Minimum setup time, \overline{SPE} to CP (t_{s3}):	
$T_C = +25^\circ\text{C}$, $V_{CC} = 4.5$ V - - - - -	12 ns
$T_C = -55^\circ\text{C}/+125^\circ\text{C}$, $V_{CC} = 4.5$ V - - - - -	18 ns
Minimum setup time, \overline{MR} to CP (t_{s4}):	
$T_C = +25^\circ\text{C}$, $V_{CC} = 4.5$ V - - - - -	13 ns
$T_C = -55^\circ\text{C}/+125^\circ\text{C}$, $V_{CC} = 4.5$ V - - - - -	20 ns
Minimum hold time, Pn to CP (t_{h1}):	
$T_C = +25^\circ\text{C}$, $V_{CC} = 4.5$ V - - - - -	5 ns
$T_C = -55^\circ\text{C}/+125^\circ\text{C}$, $V_{CC} = 4.5$ V - - - - -	5 ns
Minimum hold time, PE or TE to CP (t_{h2}):	
$T_C = +25^\circ\text{C}$, $V_{CC} = 4.5$ V - - - - -	3 ns
$T_C = -55^\circ\text{C}/+125^\circ\text{C}$, $V_{CC} = 4.5$ V - - - - -	3 ns
Minimum hold time, \overline{SPE} to CP (t_{h3}):	
$T_C = +25^\circ\text{C}$, $V_{CC} = 4.5$ V - - - - -	3 ns
$T_C = -55^\circ\text{C}/+125^\circ\text{C}$, $V_{CC} = 4.5$ V - - - - -	3 ns
Minimum recovery time, \overline{MR} to CP (t_{rec}):	
$T_C = +25^\circ\text{C}$, $V_{CC} = 4.5$ V - - - - -	15 ns
$T_C = -55^\circ\text{C}/+125^\circ\text{C}$, $V_{CC} = 4.5$ V - - - - -	22 ns
Minimum \overline{MR} pulse width (t_w):	
$T_C = +25^\circ\text{C}$, $V_{CC} = 4.5$ V - - - - -	25 ns
$T_C = -55^\circ\text{C}/+125^\circ\text{C}$, $V_{CC} = 4.5$ V - - - - -	38 ns
Maximum CP frequency (f_{max}):	
$T_C = +25^\circ\text{C}$, $V_{CC} = 4.5$ V - - - - -	30 MHz
$T_C = -55^\circ\text{C}/+125^\circ\text{C}$, $V_{CC} = 4.5$ V - - - - -	20 MHz

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<p>2. APPLICABLE DOCUMENTS</p> <p>2.1 <u>Government specification, standard, and bulletin.</u> 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.</p> <p>SPECIFICATION</p> <p>MILITARY</p> <p>MIL-M-38510 - Microcircuits, General Specification for.</p> <p>STANDARD</p> <p>MILITARY</p> <p>MIL-STD-883 - Test Methods and Procedures for Microelectronics.</p> <p>BULLETIN</p> <p>MILITARY</p> <p>MIL-BUL-103 - List of Standardized Military Drawings (SMD's).</p> <p>(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.)</p> <p>2.2 <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.</p> <p>3. REQUIREMENTS</p> <p>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.</p> <p>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.</p> <p>3.2.1 <u>Terminal connections.</u> The terminal connections shall be as specified on figure 1.</p> <p>3.2.2 <u>Truth table.</u> The truth table shall be as specified on figure 2.</p> <p>3.2.3 <u>Logic diagram.</u> The logic diagram shall be as specified on figure 3.</p> <p>3.2.4 <u>Counting sequence.</u> The counting sequence diagram shall be as specified on figure 4.</p> <p>3.2.5 <u>Case outlines.</u> The case outlines shall be in accordance with 1.2.2 herein.</p> <p>3.3 <u>Electrical performance characteristics.</u> Unless otherwise specified herein, the electrical performance characteristics are as specified in table I and apply over the full case operating temperature range.</p> <p>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.</p>			
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TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions -55°C < T _C < +125°C 1/ unless otherwise specified	Group A subgroups	Limits		Unit
				Min	Max	
High level output voltage	V _{OH}	V _{CC} = 4.5 V; V _{IN} = 2.0 V or 0.8 V	I _O = 20 μA	1, 2, 3	4.4	V
					I _O = 4.0 mA	
Low level output voltage	V _{OL}	V _{CC} = 4.5 V; V _{IN} = 2.0 V or 0.8 V	I _O = 20 μA	1, 2, 3	0.1	V
					I _O = 4.0 mA	
High level input voltage	V _{IH}	V _{CC} = 4.5 V 2/	1, 2, 3	2.0	V	
Low level input voltage	V _{IL}	V _{CC} = 4.5 V 2/	1, 2, 3	0.8	V	
Input capacitance	C _{IN}	V _{IN} = 0 V, T _C = +25°C, see 4.3.1c	4	10	pF	
Quiescent current	I _{CC}	V _{CC} = 5.5 V; V _{IN} = V _{CC} or GND I _{OUT} = 0.0 A	1, 2, 3	40	μA	
Input leakage current	I _{IN}	V _{CC} = 5.5 V; V _{IN} = V _{CC} or GND	1, 2, 3	±1.0	μA	
Functional tests		See 4.3.1d	7, 8			
Additional quiescent supply current	ΔI _{CC}	Any 1 input: V _{IN} = 2.4 V Other inputs: V _{IN} = V _{CC} or GND I _{OUT} = 0.0 A V _{CC} = 5.5 V	1, 2, 3	515	μA	

See footnotes at end of table.

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TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions -55°C < T _C < +125°C 1/ unless otherwise specified	Group A subgroups	Limits		Unit
				Min	Max	
Propagation delay time, CP to TC	t _{PHL1} , t _{PLH1}	V _{CC} = 5.0 V ±10%, C _L = 50 pF ±10%, See figure 5	9		42	ns
			10, 11		63	
Propagation delay time, CP to Qn	t _{PHL2} , t _{PLH2}		9		39	ns
			10, 11		59	
Propagation delay time, TE to TC	t _{PHL3} , t _{PLH3}		9		32	ns
			10, 11		48	
Propagation delay time, MR to TC	t _{PHL4}		9		50	ns
			10, 11		75	
Transition time 3/	t _{TLH} , t _{THL}		9		15	ns
			10, 11		22	

1/ For a power supply of 5 V ±10 percent, 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/ The V_{IH} and V_{IL} tests are not required and shall be applied as forcing functions for the V_{OH} or V_{OL} tests.

3/ Transition time (t_{TLH} and t_{THL}), if not tested, shall be guaranteed to the specified limits in table I.

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.

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Case outline	E
Terminal number	Terminal symbol
1	MR
2	CP
3	P0
4	P1
5	P2
6	P3
7	PE
8	GND
9	SPE
10	TE
11	Q3
12	Q2
13	Q1
14	Q0
15	TC
16	VCC

FIGURE 1. Terminal connections.

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Operating mode	Inputs						Outputs		
	MR	CP	PE	TE	SPE	Pn	Qn	TC	
Reset (clear)	1		X	X	X	X	L	L	
Parallel load	h		X	X	1	1	L	L	
	h		X	X	1	h	H	(a)	
Count	h		h	h	h	X	count	(a)	
Inhibit	h	X	1	X	h	X	qn	(a)	
	h	X	X	1	h	X	qn	L	

H = HIGH voltage level steady state

L = LOW voltage level steady state

X = Irrelevant

= Transition from LOW to HIGH

h = HIGH voltage level one setup time prior to the LOW-to-HIGH clock transition.

1 = LOW voltage level one setup time prior to the LOW-to-HIGH clock transition.

q = Lower case letters indicate the state of the referenced output prior to the LOW-to-HIGH clock transition.

(a) = The TC output is HIGH when TE is HIGH and the counter is at Terminal Count (HLLH).

FIGURE 2. Truth table.

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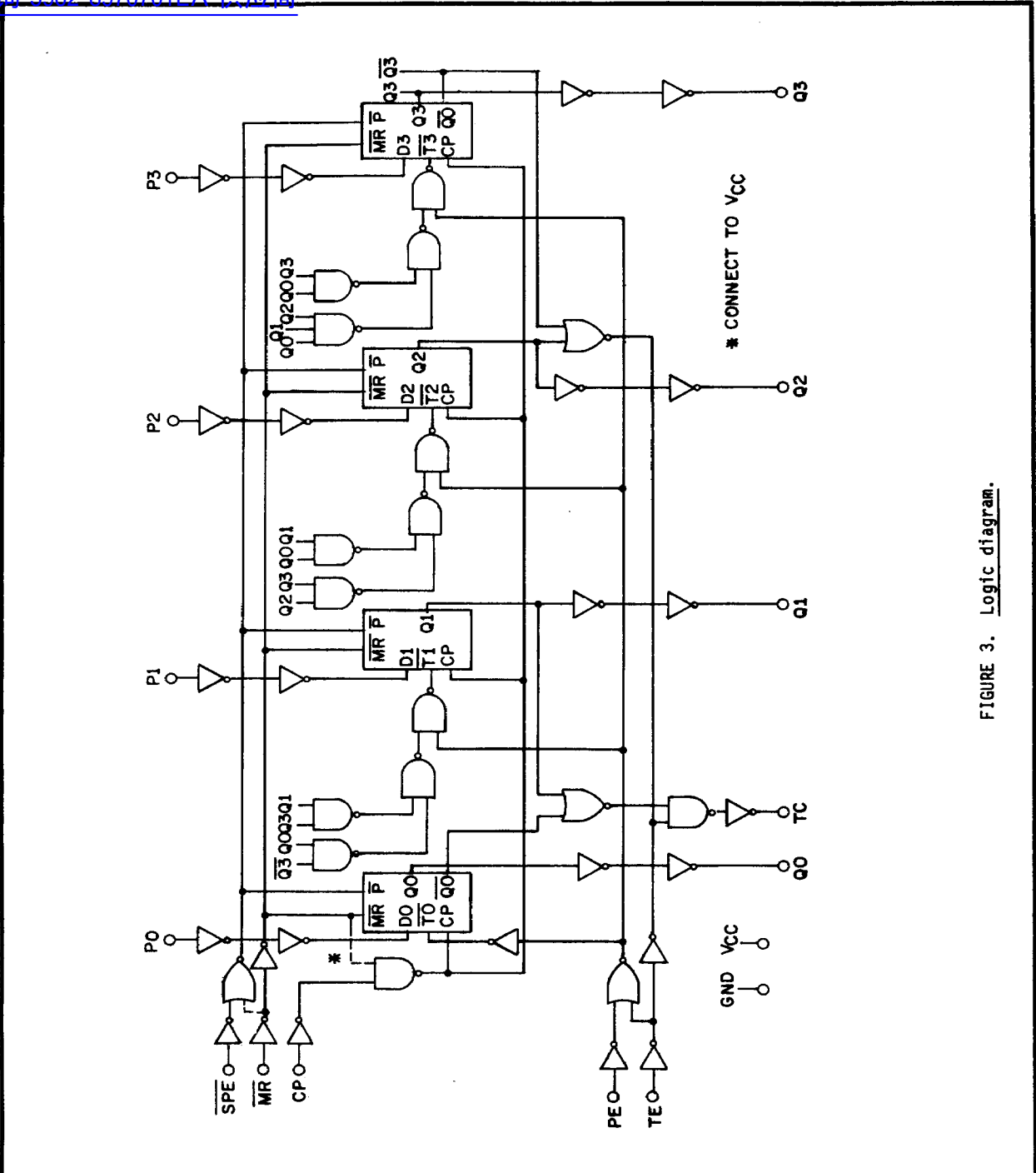
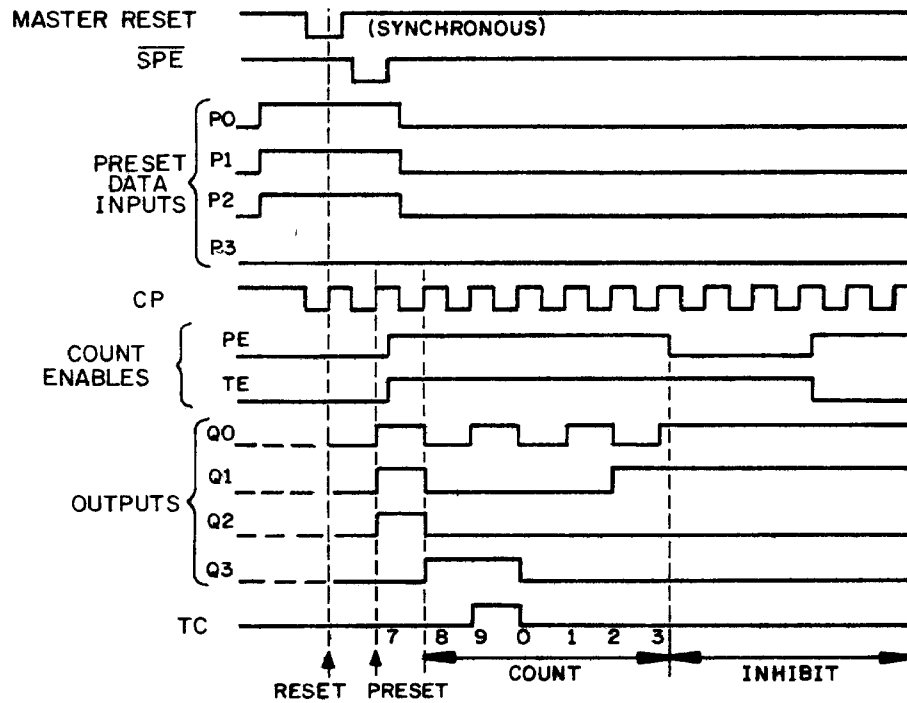


FIGURE 3. Logic diagram.

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NOTE: Sequence illustrated in waveforms:

1. Reset outputs to zero.
2. Preset to BCD seven.
3. Count to eight, nine, zero, one, two, and three.
4. Inhibit.

FIGURE 4. Counting sequence.

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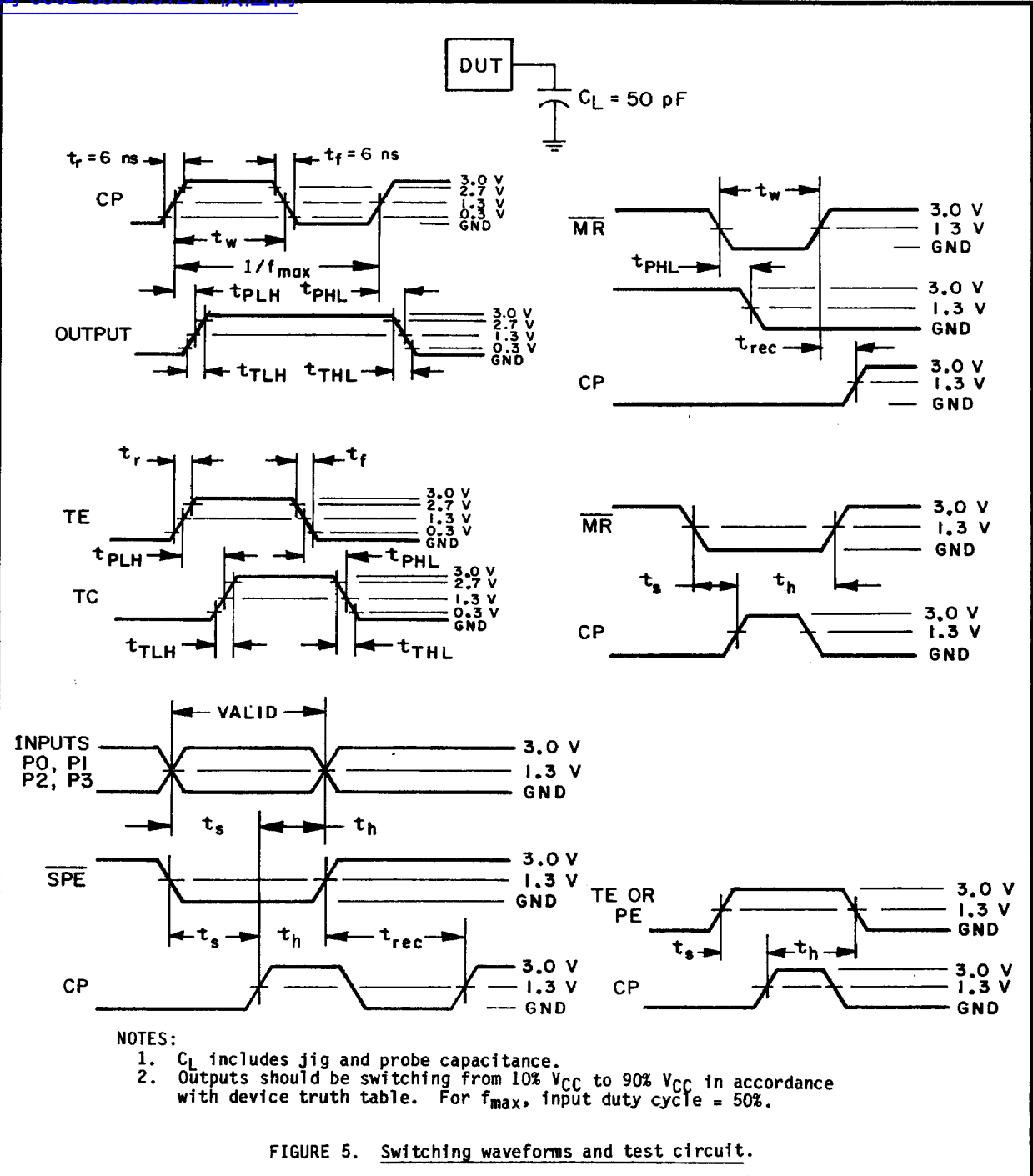


FIGURE 5. Switching waveforms and test circuit.

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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.

TABLE II. Electrical test requirements.

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

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) 296-5375.

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

Military drawing part number	Vendor CAGE number	Vendor similar part number <u>1/</u>
5962-8970701EX	18714	CD54HCT162F/3A

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

Vendor CAGE number

18714

Vendor name and address

RCA Corporation
Semiconductor Sector
Route 202
Somerville, NJ 08876

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