Device 01 inactive for new design as of 22 September 1978. Use M38510/31501B--.	REVISIONS			
	LTR	DESCRIPTION	DATE	APPROVED
	C	Revised to military drawing format. Delete vendors: CAGE 07263, 27014, and 18324. Add note for no approved source available for packages A and B. Add LCC package, case outline 2. Table I, f_{MAX} (A to Q_A, C_L = 15 pF, 10 and 11); change 20 MHz to 19 MHz. (50 pF, 10 and 11); change 23 MHz to 18 MHz. (B to Q_B, C_L = 15 pF, 10 and 11); change from 11 MHz to 10 MHz. Change I_{IH3}, 40 µA to 80 µA, I_{IH4}, 200 µA to 400 µA, I_{IH5}, 80 µA to 160 µA, I_{IH6}, 400 µA to 800 µA. Add logic diagram. Change CAGE number to 67268.	5 Oct 1987	RPEvans

CURRENT CAGE CODE 67268

REV STATUS OF PAGES	REV	C	C	C	C	C	C	C	C	C	C	C	C	C							
	PAGES	1	2	3	4	5	6	7	8	9	10	11	12	13							

Defense Electronics Supply Center Dayton, Ohio

PREPARED BY Monica L. Gusel

CHECKED BY

Original date of drawing:

24 Nov 1976

APPROVED BY Robert P. Evans

MILITARY DRAWING

This drawing is available for use by all Departments and Agencies of the Department of Defense

TITLE: MICROCIRCUITS, DIGITAL, LOW POWER SCHOTTKY TTL, COUNTER, MONOLITHIC SILICON

SIZE A	CODE IDENT. NO. 14933	DWG NO. 76032		
REV C		PAGE 1	OF	13

AMSC N/A

5962-E297

DESC FORM 193
MAY 86

1. SCOPE

1.1 <u>Scope</u>. 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 <u>Part number</u>. The complete part number shall be as shown in the following example:

```
      76032              01              C              X
        |                |               |              |
        |                |               |              |
        |                |               |              |
 Drawing number     Device type     Case outline   Lead finish per
                      (1.2.1)          (1.2.2)      MIL-M-38510
```

1.2.1 <u>Device type</u>. The device type shall identify the circuit function as follows:

Device type	Generic number	Circuit
01	54LS90	Decade counter

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

Outline letter	Case outline
A	F-1 (14-lead, 1/4" x 1/4"), flat package
B	F-3 (14-lead, 3/16" x 1/4"), flat package
C	D-1 (14-lead, 1/4" x 3/4"), dual-in-line package
D	F-2 (14-lead, 1/4" x 3/8"), flat package
2	C-2 (20-terminal, .350" x .350"), square chip carrier package

1.3 <u>Absolute maximum ratings</u>.

Supply voltage range - - - - - - - - - - - - - -	-0.5 V dc to +7.0 V dc
Input voltage range- - - - - - - - - - - - - - -	-1.5 V dc at -18 mA to +5.5 V dc
Maximum power dissipation (P_D) per device - -	85 mW 1/
Storage temperature - - - - - - - - - - - - - -	-65°C to +150°C
Lead temperature (soldering, 10 seconds) - - -	+300°C
Junction temperature (T_J)- - - - - - - - - - -	+175°C
Thermal resistance, junction-to-case (θ_{JC}):	
Cases A, B, C, D, and 2- - - - - - - - - - -	See MIL-M-38510, appendix C

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

Supply voltage (V_{CC}) - - - - - - - - - - - - -	4.5 V dc minimum to 5.5 V dc maximum
Minimum high-level input voltage (V_{IH}) - - - -	2.0 V dc
Maximum low-level input voltage (V_{IL})- - - - -	0.7 V dc
Case operating temperature range (T_C)- - - - -	-55°C to +125°C

1/ Must withstand the added P_D due to short circuit test (e.g., I_{OS}).

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2. APPLICABLE DOCUMENTS

2.1 Government specification and standard. Unless otherwise specified, the following specification and standard, 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.

(Copies of the specification and standard 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 tables. The truth tables shall be as specified on figure 2.

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

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

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

3.4 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 6.4 herein.

3.5 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 6.4. The certificate of compliance submitted to DESC-ECS prior to listing as an approved source of supply shall state that the manufacturer's product meets the requirements of MIL-STD-883 (see 3.1 herein) and the requirements herein.

3.6 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.

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

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TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions $-55°C \leq T_C \leq +125°C$ unless otherwise specified	Group A subgroups	Limits Min	Limits Max	Unit
High-level output voltage	V_{OH}	$V_{CC} = 4.5$ V $\quad I_{OH} = -0.4$ mA $V_{IH} = 2.0$ V $\quad V_{IL} = 0.7$ V	1, 2, 3	2.5		V
Low-level output voltage	V_{OL}	$V_{CC} = 4.5$ V $\quad I_{OL} = 4.0$ mA $V_{IH} = 2.0$ V $\quad V_{IL} = 0.7$ V	1, 2, 3		0.4	V
Input clamp voltage	V_{IC}	$V_{CC} = 4.5$ V; $I_{IN} = -18$ mA	1		-1.5	V
Input current at reset inputs	I_{IH1}	$V_{CC} = 5.5$ V; $V_{IH} = 2.7$ V	1, 2, 3		20	µA
	I_{IH2}	$V_{CC} = 5.5$ V; $V_{IH} = 5.5$ V	1, 2, 3		100	µA
	I_{IL1}	$V_{CC} = 5.5$ V; $V_{IL} = 0.4$ V	1, 2, 3		-0.4	mA
Input current at A input	I_{IH3}	$V_{CC} = 5.5$ V; $V_{IH} = 2.7$ V	1, 2, 3		80	µA
	I_{IH4}	$V_{CC} = 5.5$ V; $V_{IH} = 5.5$ V	1, 2, 3		400	µA
	I_{IL2}	$V_{CC} = 5.5$ V; $V_{IL} = 0.4$ V	1, 2, 3		-2.4	mA
Input current at B input	I_{IH5}	$V_{CC} = 5.5$ V; $V_{IH} = 2.7$ V	1, 2, 3		160	µA
	I_{IH6}	$V_{CC} = 5.5$ V; $V_{IH} = 5.5$ V	1, 2, 3		800	µA
	I_{IL3}	$V_{CC} = 5.5$ V; $V_{IL} = 0.4$ V	1, 2, 3		-3.2	mA
Short-circuit output current	I_{OS}	$V_{CC} = 5.5$ V $V_{OUT} = 0.0$ V $\quad \underline{1/}$	1, 2, 3	-15	-130	mA
Supply current	I_{CC}	$V_{CC} = 5.5$ V	1, 2, 3		15	mA
Functional tests		See 4.3.1c	7			

See footnotes at end of table.

TABLE I. <u>Electrical performance characteristics</u> - Continued.

Test	Symbol	Conditions -55°C ≤ T_C ≤ +125°C unless otherwise specified		Group A subgroups	Limits		Unit
					Min	Max	
Maximum clock frequency from A to Q_A	f_{MAX1}	V_{CC} = 5.0 V R_L = 2 kΩ ±5% 2/	C_L = 15 pF ±10%	9	32		MHz
				10, 11	19		
			C_L = 50 pF ±10%	9	28		MHz
				10, 11	18		
Maximum clock frequency from B to Q_B	f_{MAX2}		C_L = 15 pF ±10%	9	16		MHz
				10, 11	10		
			C_L = 50 pF ±10%	9	11		MHz
				10, 11	6		
Propagation delay time, from A to Q_A	t_{PHL1}		C_L = 15 pF ±10%	9		18	ns
				10, 11		25	
			C_L = 50 pF ±10%	9		23	ns
				10, 11		32	
	t_{PLH1}		C_L = 15 pF ±10%	9		16	ns
				10, 11		22	
			C_L = 50 pF ±10%	9		21	ns
				10, 11		29	
Propagation delay time, from A to Q_D	t_{PHL2}		C_L = 15 pF ±10%	9		50	ns
				10, 11		70	
			C_L = 50 pF ±10%	9		55	ns
				10, 11		77	
	t_{PLH2}		C_L = 15 pF ±10%	9		48	ns
				10, 11		67	
			C_L = 50 pF ±10%	9		53	ns
				10, 11		74	

See footnotes at end of table.

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TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions $-55°C \leq T_C \leq +125°C$ unless otherwise specified		Group A subgroups	Limits		Unit
					Min	Max	
Propagation delay time, from B to Q_B	t_{PHL3}	$V_{CC} = 5.0$ V $R_L = 2$ kΩ ±10% 2/	$C_L = 15$ pF ±10%	9		21	ns
				10, 11		29	
			$C_L = 50$ pF ±10%	9		26	ns
				10, 11		36	
	t_{PLH3}		$C_L = 15$ pF ±10%	9		16	ns
				10, 11		22	
			$C_L = 50$ pF ±10%	9		21	ns
				10, 11		29	
Propagation delay time, from B to Q_C	t_{PHL4}		$C_L = 15$ pF ±10%	9		35	ns
				10, 11		49	
			$C_L = 50$ pF ±10%	9		40	ns
				10, 11		56	
	t_{PLH4}		$C_L = 15$ pF ±10%	9		32	ns
				10, 11		45	
			$C_L = 50$ pF ±10%	9		37	ns
				10, 11		52	
Propagation delay time, from B to Q_D	t_{PHL5}		$C_L = 15$ pF ±10%	9		35	ns
				10, 11		49	
			$C_L = 50$ pF ±10%	9		40	ns
				10, 11		56	
	t_{PLH5}		$C_L = 15$ pF ±10%	9		32	ns
				10, 11		45	
			$C_L = 50$ pF ±10%	9		37	ns
				10, 11		52	

See footnotes at end of table.

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TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions -55°C $\leq$ T$_C$ $\leq$ +125°C unless otherwise specified		Group A subgroups	Limits		Unit
					Min	Max	
Propagation delay time, from set-to-0 to output	tPHL6	V$_{CC}$ = 5.0 V R$_L$ = 2 kΩ ±10% 2/	C$_L$ = 15 pF ±10%	9		40	ns
				10, 11		56	
			C$_L$ = 50 pF ±10%	9		45	ns
				10, 11		63	
Propagation delay time, from set-to-9 to Q$_B$ or Q$_C$	tPHL7		C$_L$ = 15 pF ±10%	9		40	ns
				10, 11		56	
			C$_L$ = 50 pF ±10%	9		45	ns
				10, 11		63	
Propagation delay time, from set-to-9 to Q$_A$ or Q$_D$	tPLH7		C$_L$ = 15 pF ±10%	9		30	ns
				10, 11		42	
			C$_L$ = 50 pF ±10%	9		35	ns
				10, 11		49	

1/ Not more than one output should be shorted at a time, and the duration of the short circuit condition should not exceed one second.

2/ Propagation delay time testing and maximum clock frequency testing may be performed using either C$_L$ = 15 pF or C$_L$ = 50 pF. However, the manufacturer must certify and guarantee that the microcircuits meet the switching test limits specified for a 50 pF load.

3.8 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).

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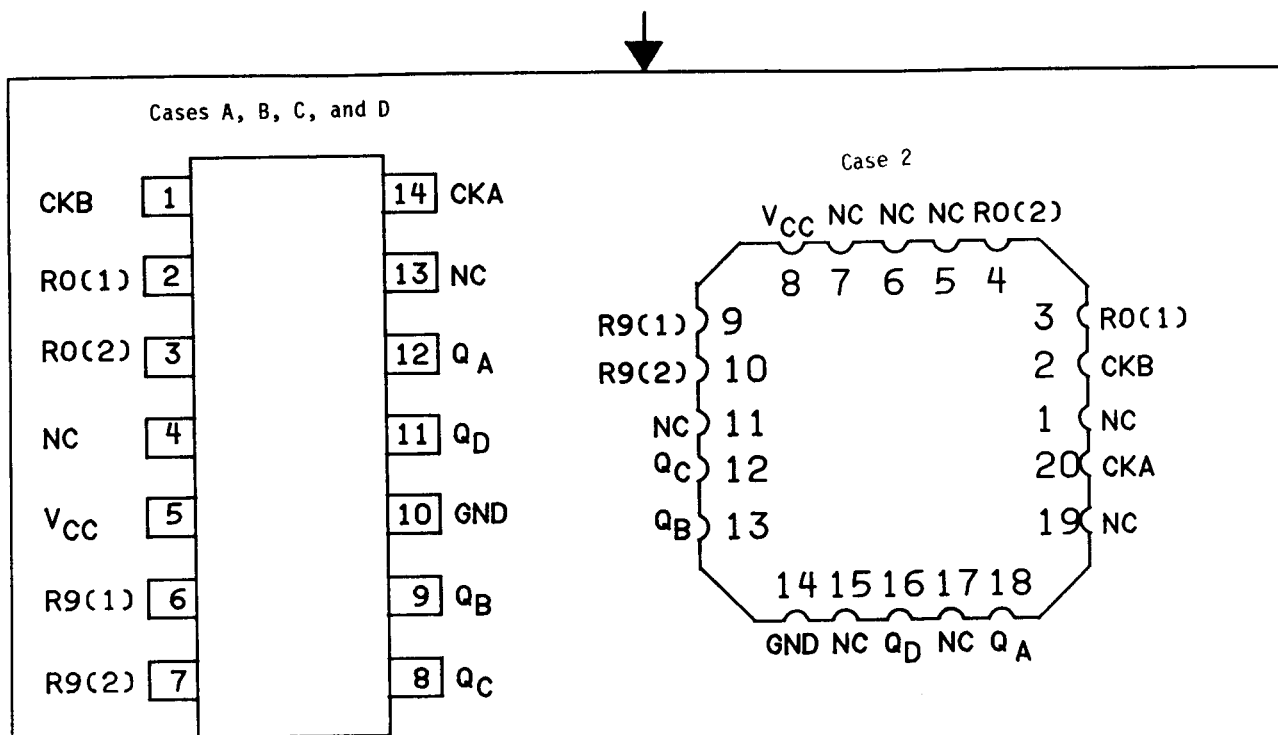DAYTON, OHIO

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Cases A, B, C, and D

CKB [1]   [14] CKA

RO(1) [2]   [13] NC

RO(2) [3]   [12] Q$_A$

NC [4]   [11] Q$_D$

V$_{CC}$ [5]   [10] GND

R9(1) [6]   [9] Q$_B$

R9(2) [7]   [8] Q$_C$

Case 2

V$_{CC}$ NC NC NC RO(2)

8 7 6 5 4

R9(1)) 9   3 (RO(1)
R9(2)) 10   2 (CKB
NC) 11   1 (NC
Q$_C$) 12   20 (CKA
Q$_B$) 13   19 (NC

14 15 16 17 18

GND NC Q$_D$ NC Q$_A$

FIGURE 1. Terminal connections

Reset/count function table

Reset inputs				Output			
R$_{0(1)}$	R$_{0(2)}$	R9(1)	R9(2)	Q$_D$	Q$_C$	Q$_B$	Q$_A$
H	H	L	X	L	L	L	L
H	H	X	L	L	L	L	L
X	X	H	H	H	L	L	H
X	L	X	L		Count		
L	X	L	X		Count		
L	X	X	L		Count		
X	L	L	X		Count		

NOTES:
A. Output Q$_A$ is connected to input B for BCD count.
B. Output Q$_D$ is connected to input A for bi-quinary count.
C. H = high level, L = low level, X = irrelevant.

FIGURE 2. Truth table.

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BI-Quinary (5-2)
(See note B)

Count	Output			
	Q_A	Q_D	Q_C	Q_B
0	L	L	L	L
1	L	L	L	H
2	L	L	H	L
3	L	L	H	H
4	L	H	L	L
5	H	L	L	L
6	H	L	L	H
7	H	L	H	L
8	H	L	H	H
9	H	H	L	L

BCD count sequence
(See note A)

Count	Output			
	Q_D	Q_C	Q_B	Q_A
0	L	L	L	L
1	L	L	L	H
2	L	L	H	L
3	L	L	H	H
4	L	H	L	L
5	L	H	L	H
6	L	H	H	L
7	L	H	H	H
8	H	L	L	L
9	H	L	L	H

FIGURE 2.   Truth table - Continued.

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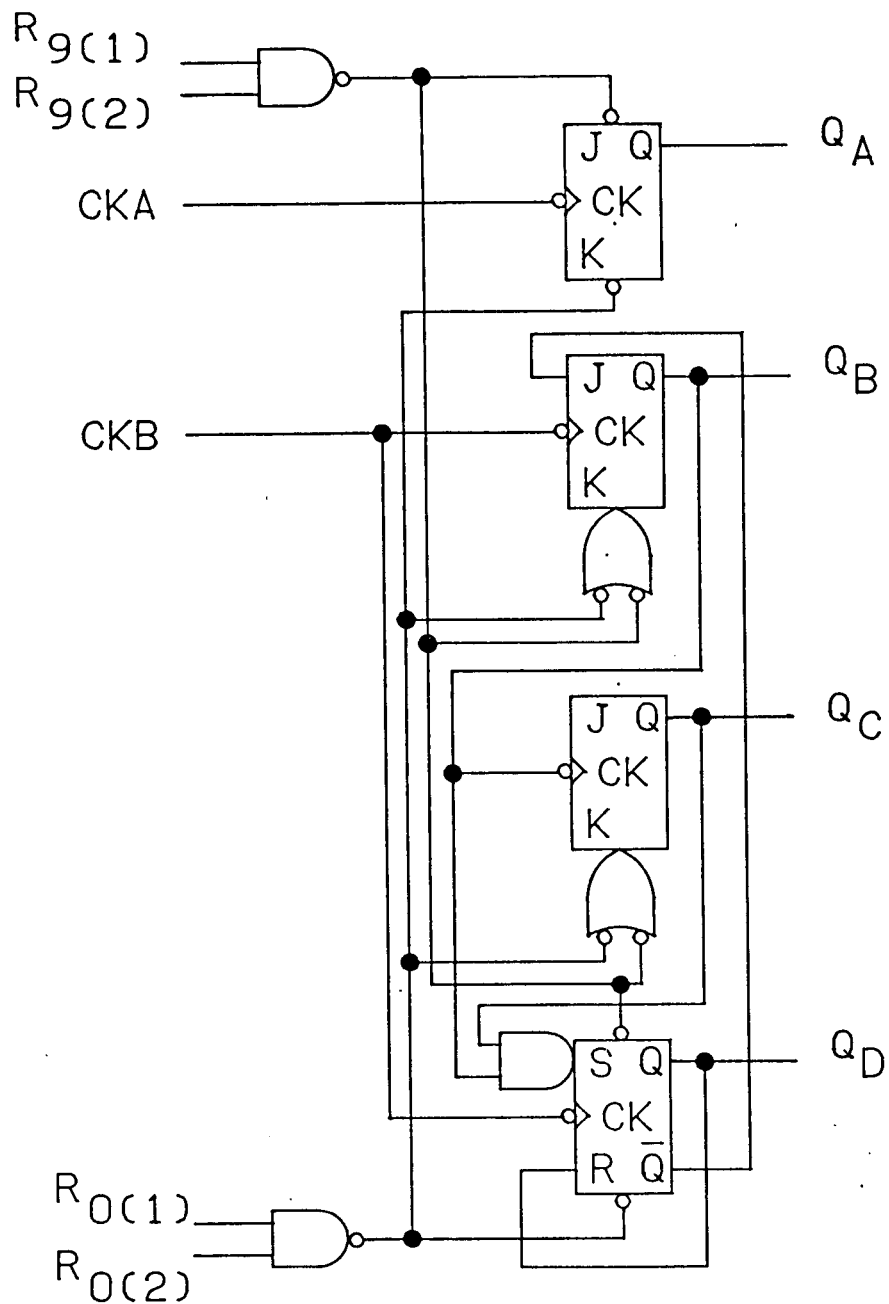
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FIGURE 3. Logic diagram.

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 using the circuit submitted with the certificate of compliance (see 3.5 herein).

        (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.

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

MIL-STD-883 test requirements	Subgroups (per method 5005, table I)
Interim electrical parameters (method 5004)	---
Final electrical test parameters (method 5004)	1*, 2, 3, 9
Group A test requirements (method 5005)	1, 2, 3, 7, 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 <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 4, 5, 6, and 8 in table I, method 5005 of MIL-STD-883 shall be omitted.

    c. Subgroup 7 tests shall verify the truth table.

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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 (method 1005 of MIL-STD-883) conditions:

  (1) Test condition A, B, C, or D using the circuit submitted with the certificate of compliance (see 3.5 herein).

  (2) T_A = +125°C, minimum.

  (3) Test duration: 1,000 hours, except as permitted by appendix B of MIL-M-38510 and 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. Replaceability is determined as follows:

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

 b. When a QPL source is established, the part numbered device specified in this drawing will be replaced by the microcircuit identified as part number M38510/31501B--.

6.3 Comments. Comments on this drawing should be directed to DESC-ECS, Dayton, OH 45444, or telephone 513-296-5375.

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6.4 Approved sources of supply. Approved sources of supply are listed herein. Additional sources will be added as they become available. The vendors listed herein have agreed to this drawing and a certificate of compliance (see 3.5 herein) has been submitted to DESC-ECS.

Military drawing part number	Vendor CAGE number	Vendor similar part number 1/	Replacement military specification part number
7603201AX 2/	3/	---	M38510/31501BAX
7603201BX 2/	3/	---	M38510/31501BBX
7603201CX 2/	04713 01295	54LS90/BCAJC SNJ54LS90J	M38510/31501BCX
7603201DX 2/	04713 01295	54LS90/BDAJC SNJ54LS90W	M38510/31501BDX
76032012X 2/	04713	54LS90M/B2AJC	M38510/31501B2X

1/ Caution. Do not use this number for item acquisition. Items acquired to this number may not satisfy the performance requirements of this drawing.
2/ Inactive for new design. Use QPL-38510 product.
3/ No approved source available for this device.

Vendor CAGE number	Vendor name and address
04713	Motorola, Inc. 7402 South Price Road Tempe, AZ 85283
01295	Texas Instruments, Inc. P.O. Box 6448 Midland, TX 79701

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