REVISIONS			
LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED
B	Convert to military drawing format. Add case outline 2 (square chip carrier package) for vendor CAGE number 27014. Editorial changes throughout.	88 MAR 23	
C	Changes to 1.3 and 1.4. Add vendor CAGE 18324 for device types 01CX, 01DX, and 012X. Device types 01CX and 012X inactive for new design; use M38510/66309BCX and M38510/66309B2X. Timing waveform: Correct clock A waveform. Editorial change in 6.4. Editorial changes throughout.	89 JAN 11	

CURRENT CAGE CODE 67268

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

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

PREPARED BY: Jeffery Tunstall

CHECKED BY: Ray Monnin

APPROVED BY:

DRAWING APPROVAL DATE: 26 SEPTEMBER 1984

REVISION LEVEL: C

DEFENSE ELECTRONICS SUPPLY CENTER
DAYTON, OHIO 45444

MICROCIRCUITS, DIGITAL, HIGH-SPEED, CMOS DUAL, 4-BIT, BINARY COUNTER, MONOLITHIC SILICON

SIZE	CAGE CODE	
A	14933	84100

SHEET 1 OF 13

DESC FORM 193-1
SEP 87

* U.S. GOVERNMENT PRINTING OFFICE: 1987 — 748-129/60912

5962-E1012-1

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:

84100	01	B	X
Drawing number	Device type (1.2.1)	Case outline (1.2.2)	Lead finish per 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	54HC393	Dual 4-bit binary 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
B	F-3 (14-lead, .280" x .200" x .070"), flat package
C	D-1 (14-lead, .785" x .310" x .200"), dual-in-line package
D	F-2 (14-lead, .390" x .260" x .085"), flat package
2	C-2 (20-terminal, .358" x .358" x .100") square chip carrier 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)	±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)	500 mW 2/
Lead temperature (soldering, 10 seconds)	+260°C
Thermal resistance, junction-to-case (θ_{JC})	See MIL-M-38510, appendix C
Junction temperature (T_J)	+175°C

1.4 Recommended operating conditions.

Supply voltage	+2.0 V dc to +6.0 V dc
Case operating temperature range (T_C)	-55°C to +125°C
Maximum input rise or fall time (t_r, t_f):	
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°C to +125°C, derate linearly at 12 mW/°C.

Minimum width of clock, or reset pulse (t_w):
T_C = +25°C; C_L = 50 pF:
V_{CC} = 2.0 V - 80 ns
V_{CC} = 4.5 V - 16 ns
V_{CC} = 6.0 V - 14 ns
T_C = -55°C, +125°C; C_L = 50 pF:
V_{CC} = 2.0 V - 120 ns
V_{CC} = 4.5 V - 24 ns
V_{CC} = 6.0 V - 20 ns
Maximum clock frequency (f_{MAX}):
T_C = +25°C; C_L = 50 pF:
V_{CC} = 2.0 V - 5 MHz
V_{CC} = 4.5 V - 25 MHz
V_{CC} = 6.0 V - 29 MHz
T_C = -55°C, +125°C; C_L = 50 pF:
V_{CC} = 2.0 V - 3.4 MHz
V_{CC} = 4.5 V - 17 MHz
V_{CC} = 6.0 V - 20 MHz
Minimum recovery time, clear to clock (t_{rec}):
T_C = 25°C; C_L = 50 pF:
V_{CC} = 2.0 V - 50 ns
V_{CC} = 4.5 V - 10 ns
V_{CC} = 6.0 V - 9 ns
T_C = -55°C, +125°C; C_L = 50 pF:
V_{CC} = 2.0 V - 75 ns
V_{CC} = 4.5 V - 15 ns
V_{CC} = 6.0 V - 13 ns

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 Logic diagram, truth table, and timing waveforms. The logic diagram, truth table, and timing waveforms shall be as specified on figure 2.

3.2.3 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 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).

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).

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 3.5 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.

TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions $-55°C \le T_C \le +125°C$ unless otherwise specified 1/		Group A subgroups	Limits		Unit
					Min	Max	
High level output voltage	V_{OH}	$V_{IN} = V_{IH}$ or V_{IL} $\lvert I_O \rvert \le 20\ \mu A$	$V_{CC} = 2.0$ V	1, 2, 3	1.9		V
			$V_{CC} = 4.5$ V		4.4		
			$V_{CC} = 6.0$ V		5.9		
		$V_{IN} = V_{IH}$ or V_{IL} $\lvert I_O \rvert \le 4.0$ mA	$V_{CC} = 4.5$ V		3.7		
		$V_{IN} = V_{IH}$ or V_{IL} $\lvert I_O \rvert \le 5.2$ mA	$V_{CC} = 6.0$ V		5.2		
Low level output voltage	V_{OL}	$V_{IN} = V_{IH}$ or V_{IL} $\lvert I_O \rvert \le 20\ \mu A$	$V_{CC} = 2.0$ V	1, 2, 3		0.1	V
			$V_{CC} = 4.5$ V			0.1	
			$V_{CC} = 6.0$ V			0.1	
		$V_{IN} = V_{IH}$ or V_{IL} $\lvert I_O \rvert \le 4.0$ mA	$V_{CC} = 4.5$ V			0.4	
		$V_{IN} = V_{IH}$ or V_{IL} $\lvert I_O \rvert \le 5.2$ mA	$V_{CC} = 6.0$ V			0.4	
High level input voltage	V_{IH}	2/	$V_{CC} = 2.0$ V	1, 2, 3	1.5		V
			$V_{CC} = 4.5$ V		3.15		
			$V_{CC} = 6.0$ V		4.2		

See footnotes at end of table.

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TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions $-55°C < T_C < +125°C$ unless otherwise specified 1/		Group A subgroups	Limits Min	Limits Max	Unit
Low level input voltage	V_{IL}	2/	V_{CC} = 2.0 V	1, 2, 3		0.3	V
			V_{CC} = 4.5 V			0.9	
			V_{CC} = 6.0 V			1.2	
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} = 6.0 V, V_{IN} = V_{CC} or GND		1, 2, 3		160	µA
Input leakage current	I_{IN}	V_{CC} = 6.0 V, V_{IN} = V_{CC} or GND		1, 2, 3		±1	µA
Functional tests		See 4.3.1d		7			
Propagation delay time, input (clock 1A, 2A) to output $1Q_A$, $2Q_A$, respectively 3/	t_{PHL1} t_{PLH1}	T_C = +25°C C_L = 50 pF ±10% See figure 3	V_{CC} = 2.0 V	9		135	ns
			V_{CC} = 4.5 V			27	
			V_{CC} = 6.0 V			23	
		T_C = -55°C, +125°C C_L = 50 pF ±10% See figure 3	V_{CC} = 2.0 V	10, 11		205	ns
			V_{CC} = 4.5 V			41	
			V_{CC} = 6.0 V			35	

See footnotes on next page.

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions $-55°C \le T_C \le +125°C$ unless otherwise specified 1/		Group A subgroups	Limits Min	Limits Max	Unit
Propagation delay time, input (clock 1A, 2A) to output $1Q_D$, $2Q_D$, respectively 3/	t_{PHL2} t_{PLH2}	T_C = +25°C C_L = 50 pF ±10% See figure 3	V_{CC} = 2.0 V	9		310	ns
			V_{CC} = 4.5 V			62	
			V_{CC} = 6.0 V			53	
		T_C = -55°C, +125°C, C_L = 50 pF ±10% See figure 3	V_{CC} = 2.0 V	10, 11		465	ns
			V_{CC} = 4.5 V			93	
			V_{CC} = 6.0 V			79	
Propagation delay time, clear to any output 1 CLK to $1Q_A$ " " $1Q_B$ " " $1Q_C$ " " $1Q_D$ 3/ 2 CLK to $2Q_A$ " " $2Q_B$ " " $2Q_C$ " " $2Q_D$	t_{PHL3}	T_C = +25°C C_L = 50 pF ±10% See figure 3	V_{CC} = 2.0 V	9		165	ns
			V_{CC} = 4.5 V			33	
			V_{CC} = 6.0 V			28	
		T_C = -55°C, +125°C C_L = 50 pF ±10% See figure 3	V_{CC} = 2.0 V	10, 11		250	ns
			V_{CC} = 4.5 V			56	
			V_{CC} = 6.0 V			43	

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions $-55°C < T_C < +125°C$ unless otherwise specified 1/		Group A subgroups	Limits Min	Limits Max	Unit
Transition time 4/	t_{THL} t_{TLH}	T_C = +25°C	V_{CC} = 2.0 V	9		75	ns
		C_L = 50 pF ±10%	V_{CC} = 4.5 V			15	
		See figure 3	V_{CC} = 6.0 V			13	
		T_C = -55°C, +125°C	V_{CC} = 2.0 V	10, 11		110	ns
		C_L = 50 pF ±10%	V_{CC} = 4.5 V			22	
		See figure 3	V_{CC} = 6.0 V			19	

1/ For a power supply of 5.0 V ±10%, the worst case output voltages (V_{OH} and V_{OL}) occur for HC 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. (The V_{IH} value at 5.5 V is 3.85 V.) The worst case leakage currents (I_{IN}, I_{CC}, and I_{OZ}) occur for CMOS at the higher voltage so the 6.0 V values should be used. Power dissipation capacitance (C_{PD}), typically 60 pF, determines the no load dynamic power consumption, $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$, and the no load dynamic current consumption (I_S), $I_S = C_{PD} V_{CC} f + I_{CC}$.
2/ V_{IH} and V_{IL} tests are not required if applied as a forcing function for V_{OH} and V_{OL}.
3/ AC testing at V_{CC} = 2.0 V and V_{CC} = 6.0 V shall be guaranteed, if not tested, to the specified parameters.
4/ Transition times (t_{THL}, t_{TLH}), if not tested, shall be guaranteed to the specified limits.

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.

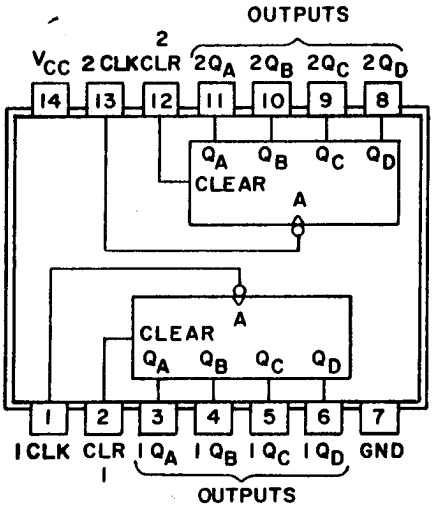
b. Subgroups 5, 6, and 8 in table I, method 5005 of MIL-STD-883 shall be omitted.

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. Subgroup 7 tests shall verify the truth table as specified on figure 2.

Device type 01

Cases B, C, and D



Case 2

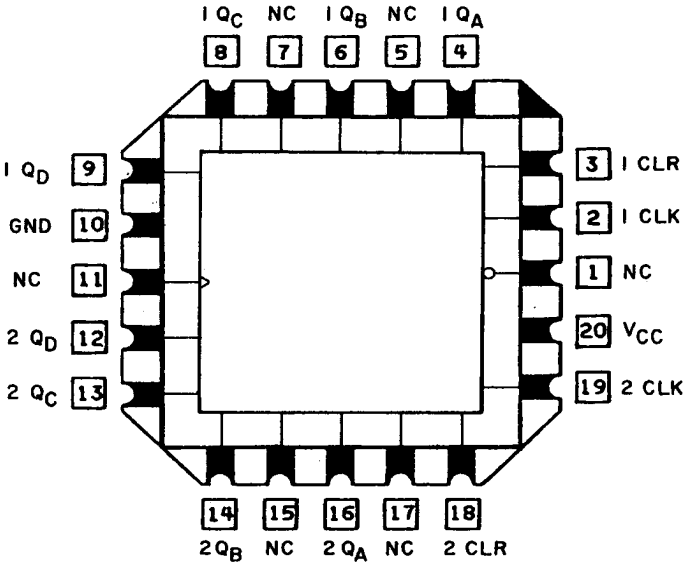


FIGURE 1. Terminal connections (top view).

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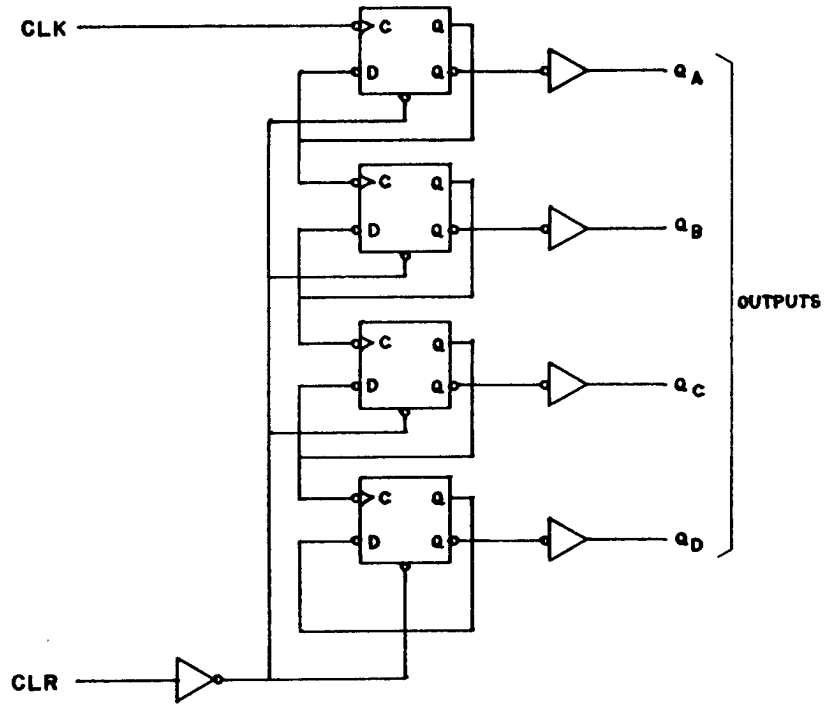
		REVISION LEVEL C	SHEET 9

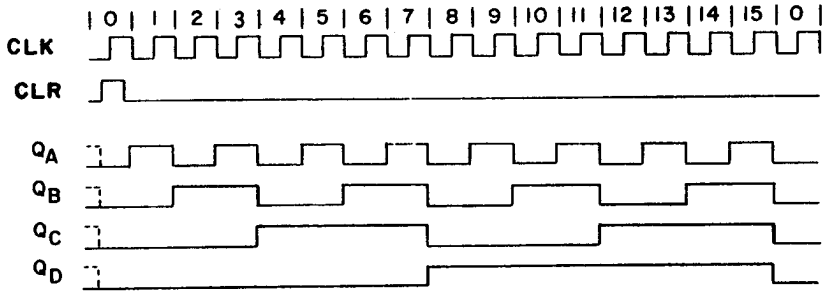
Device type 01



LOGIC DIAGRAM

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
10	H	L	H	L
11	H	L	H	H
12	H	H	L	L
13	H	H	L	H
14	H	H	H	L
15	H	H	H	H

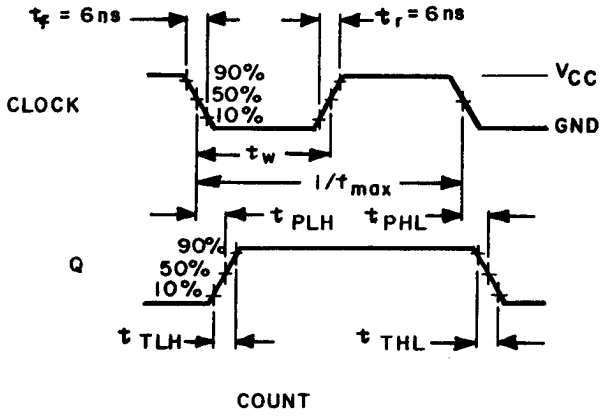
TRUTH TABLE



TIMING WAVEFORMS

FIGURE 2. Logic diagram, truth table, and timing waveforms.

Device type 01



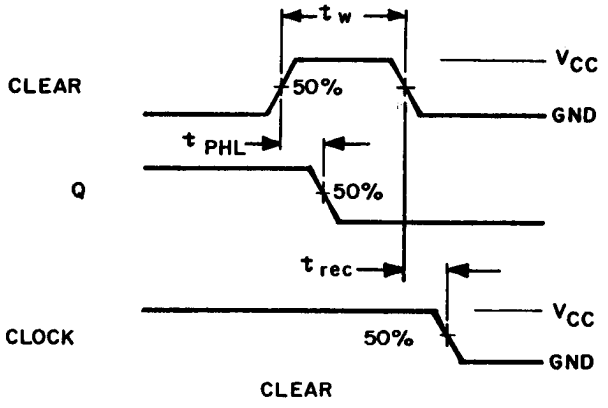


FIGURE 3. Switching waveforms.

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, 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.

4.3.2 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 3.5 herein).

(2) T_A = +125°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. 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 M38510/66309B--.

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

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
8410001BX	01295	SNJ54HC393WA	M38510/66309BBX
8410001CX 2/	01295 04713 27014 18714 18324	SNJ54HC393J 54HC393/BCAJC MM54HC393J/883B CD54HC393F/3A 54HC393/BCA	M38510/66309BCX
8410001DX	01295 18324	SNJ54HC393W 54HC393/BDA	M38510/66309BDX
84100012X 2/	01295 04713 27014 18324	SNJ54HC393FK 54HC393M/B2AJC MM54HC393E/883 54HC393/B2A	M38510/66309B2X

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 M38510/66309BCX and M38510/66309B2X.

Vendor CAGE number	Vendor name and address
01295	Texas Instruments, Incorporated P. O. Box 60448 Midland, TX 79711-0448
04713	Motorola, Incorporated 7402 S. Price Road Tempe, AZ 85283
18324	Signetics Corporation 4130 South Market Court Sacramento, CA 95834
18714	RCA Corporation Route 202 Somerville, NJ 08876
27014	National Semiconductor 2900 Semiconductor Drive Santa Clara, CA 95051