REVISIONS

LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED
A	Add case outline S (flat package) for vendor CAGE 61772. Added the A version generic part. Changes to table I. Editorial changes throughout.	91-04-28	
B	Add vendor CAGE 27014 and 75569. Technical changes in 1.4 and table I. Editorial changes throughout.	91-11-25	

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

PMIC N/A	PREPARED BY Jeffery Tunstall	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 Ray Monnin	MICROCIRCUITS, DIGITAL, FAST CMOS, OCTAL FLIP-FLOP WITH CLOCK ENABLE, MONOLITHIC SILICON		
	APPROVED BY			
	DRAWING APPROVAL DATE 23 MAY 1988	SIZE A	CAGE CODE 67268	5962-87627
AMSC N/A	REVISION LEVEL B	SHEET 1 OF 13		

DESC FORM 193
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5962-E191

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

5962-87627	01	R	X
Drawing number	Device type (1.2.1)	Case outline (1.2.2)	Lead finish per MIL-M-38510

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

Device type	Generic number	Circuit function
01	54FCT377	Octal D flip-flop with clock enable, TTL compatible
02	54FCT377A	Octal D flip-flop with clock enable, TTL compatible

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

Outline letter	Case outline
R	D-8 (20-lead, 1.060" x .310" x .200"), dual-in-line package
S	F-9 (20-lead, .540" x .300" x .100"), flat package
2	C-2 (20-terminal, .358" x .358" x .100"), square chip carrier package

1.3 Absolute maximum ratings.

Supply voltage range (V_{CC}) 1/ - - - - - - - - - - - -	-0.5 V dc to +7.0 V dc 2/
Input voltage range - - - - - - - - - - - - - - - -	-0.5 V dc to V_{CC} + 0.5 V dc
Output voltage range - - - - - - - - - - - - - - - -	-0.5 V dc to V_{CC} + 0.5 V dc
DC input diode current (I_{IK}) - - - - - - - - - - - -	-20 mA
DC output diode current (I_{OK}) - - - - - - - - - - -	-50 mA
DC output current - - - - - - - - - - - - - - - - -	100 mA
Maximum power dissapation (P_D) 3/ - - - - - - - - -	500 mW
Thermal resistance, junction-to-case (Θ_{JC}) - - - - -	See MIL-M-38510, appendix C
Storage temperature range - - - - - - - - - - - - - - -	-65°C to +150°C
Junction temperature range (T_J) - - - - - - - - - - -	+175°C
Lead temperature (soldering, 10 seconds) - - - - - -	+300°C

1.4 Recommended operating conditions.

Supply voltage range (V_{CC}) - - - - - - - - - - - - - -	+4.5 V dc to +5.5 V dc
Maximum logic low voltage (V_{IL}) - - - - - - - - - -	0.8 V dc
Minimum logic high voltage (V_{IH}) - - - - - - - - - -	2.0 V dc
Case operating temperature range (T_C) - - - - - - - -	-55°C to +125°C
Minimum setup time, data (Dn) to clock (CP), (t_{s1}):	
Device type 01 -	4.0 ns
Device type 02 -	2.0 ns

1/ All voltages referenced to GND.
2/ For V_{CC} > 6.5 V dc, the upper bound is limited to V_{CC}.
3/ Must withstand the added P_D due to short circuit test e.g., I_{OS}.

Minimum hold time, Dn to CP (t_{h1}):	
Device type 01	2.5 ns
Device type 02	1.5 ns
Minimum setup time, clock enable $\overline{CE}$ to CP, (t_{s2}):	
Device type 01	4.5 ns
Device type 02	3.5 ns
Minimum hold time, $\overline{CE}$ to CP, (t_{h2}):	
Device type 01	2.0 ns
Device type 02	1.5 ns
Minimum CP pulse width, high and low, (t_w):	
Device type 01	7.0 ns
Device type 02	7.0 ns

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 Drawings (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 logic diagram shall be as specified on figure 3.

3.2.4 Switching waveforms and test circuit. The switching waveforms and test circuit shall be as specified on figure 4 herein.

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, 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.

3.5 Marking. 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 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 = +125C, 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 ≤ T_C ≤ +125°C V_{CC} = 5.0 V dc ±10% unless otherwise specified		Device type	Group A subgroups	Limits		Unit
						Min	Max	
High level output	V_{OH}	V_{CC} = 4.5 V V_{IL} = 0.8 V V_{IH} = 2.0 V	I_{OH} = -300µA	All	1, 2, 3	4.3		V
			I_{OH} = -12 mA	All	1, 2, 3	2.4		V
Low level output voltage	V_{OL}	V_{CC} = 4.5 V V_{IL} = 0.8 V V_{IH} = 2.0 V	I_{OL} = 300µA	All	1, 2, 3		0.2	V
			I_{OL} = 32 mA	All	1, 2, 3		0.5	V
Input clamp voltage	V_{IK}	V_{CC} = 4.5 V, I_{IN} = -18 mA		All	1, 2, 3		-1.2	V
High level input current	I_{IH}	V_{CC} = 5.5 V, V_{IN} = 5.5 V		All	1, 2, 3		5	µA
Low level input current	I_{IL}	V_{CC} = 5.5 V, V_{IN} = GND		All	1, 2, 3		-5	µA
Short circuit output current	I_{OS}	V_{CC} = 5.5 V 1/		All	1, 2, 3	-60		mA
Quiescent power supply current (CMOS inputs)	I_{CCQ}	$V_{IN} \le 0.2$ V or $V_{IN} \ge 5.3$ V V_{CC} = 5.5 V, f_I = 0 MHz		All	1, 2, 3		1.5	mA
Quiescent power supply current (TTL inputs)	delta I_{CC}	V_{CC} = 5.5 V, V_{IN} = 3.4 V 2/		All	1, 2, 3		2.0	mA
Dynamic power supply current 3/	I_{CCD}	V_{CC} = 5.5 V, C_L = 50 pF min, one bit toggling 50% duty cycle, $\overline{CE}$ = GND, $V_{IN} \ge 5.3$ V and $V_{IN} \le 0.2$ V		All	1, 2, 3		0.4	mA/MHz

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions $-55^\circ C \leq T_C \leq +125^\circ C$ $V_{CC} = 5.0$ V dc ±10% unless otherwise specified		Device type	Group A subgroups	Limits		Unit
						Min	Max	
Total power supply current 4/	I_{CC}	$V_{CC} = 5.5$ V outputs open $f_{CP} = 10$ MHz 50% duty cycle CE = GND one bit toggling at $f_I = 5$ MHz 50% duty cycle	$V_{IN} \geq 5.3$ V and $V_{IN} \leq 0.2$ V	All	1, 2, 3		5.5	mA
			$V_{IN} \geq 3.4$ V and V_{IN} = GND	All	1, 2, 3		6.0	mA
Input capacitance	C_{IN}	See 4.3.1c		All	4		10	pF
Output capacitance	C_{OUT}	See 4.3.1c		All	4		12	pF
Functional tests		See 4.3.1d		All	7, 8			
Propagation delay time CP to O_n 5/	t_{PLH} t_{PHL}	$C_L = 50$ pF minimum $R_L = 500$, See figure 4		01	9, 10, 11	2.0	15.0	ns
				02		2.0	8.3	

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

2/ In accordance with TTL driven input ($V_{IN} = 3.4$ V); all other inputs at V_{CC} or GND.

3/ This parameter is not directly testable, but is derived for use in total power supply calculations.

4/ $I_{CC} = I_{CCQ} + (I_{CC}\ D_H\ N_T) + I_{CCD}(\ f_{CP}/2\ +\ f_I\ N_I)$

Where: D_H = Duty cycle for TTL inputs high
N_T = Number of TTL inputs at D_H
f_I = Input frequency in MHz
N_I = Number of inputs at f_I

5/ Minimum ac limits are guaranteed if not tested.

Device types	01 and 02	
Case outlines	R and S	2
Terminal number	Terminal symbol	
1	$\overline{CE}$	$\overline{CE}$
2	O_0	O_0
3	D_0	D_0
4	D_1	D_1
5	O_1	O_1
6	O_2	O_2
7	D_2	D_2
8	D_3	D_3
9	O_3	O_3
10	GND	GND
11	CP	CP
12	O_4	O_4
13	D_4	D_4
14	D_5	D_5
15	O_5	O_5
16	O_6	O_6
17	D_6	D_6
18	D_7	D_7
19	O_7	O_7
20	V_{CC}	V_{CC}

FIGURE 1. Terminal connections.

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Device types 01 and 02

Operating mode	Inputs			Outputs
	CP	$\overline{CE}$	D_N	O_N
Load "1"	↑	l	h	H
Load "0"	↑	l	l	L
Hold (do nothing)	↑ X	h H	X X	No change No change

H = High voltage level

h = High voltage level one setup time to the low-to-high clock transition

L = Low voltage level

l = Low voltage level one setup time prior to the low-to-high clock transition

X = Don't care

↑ = Low-to-high clock transition

FIGURE 2. Truth table.

Device types 01 and 02

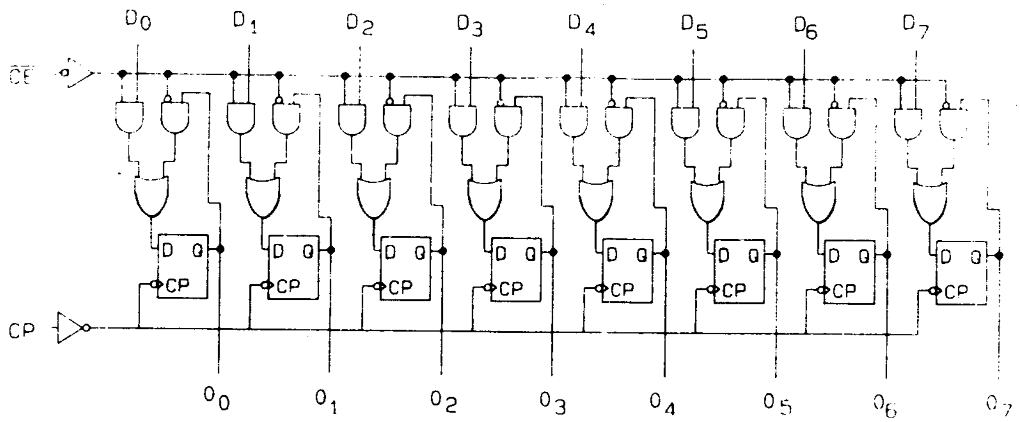

FIGURE 3. Logic diagram.

Device types 01 and 02

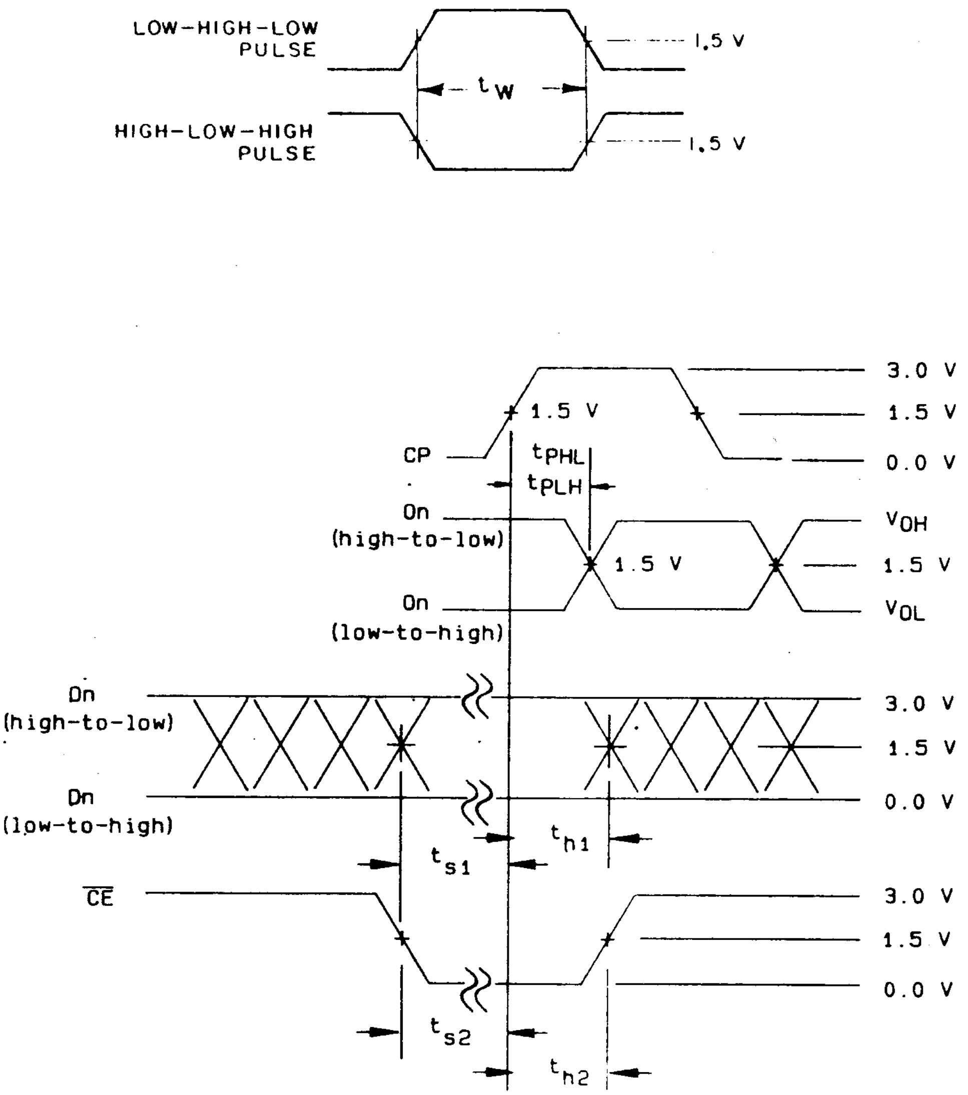

FIGURE 4. Switching waveforms and test circuit.

STANDARDIZED MILITARY DRAWING DEFENSE ELECTRONICS SUPPLY CENTER DAYTON, OHIO 45444	SIZE A		5962-87627
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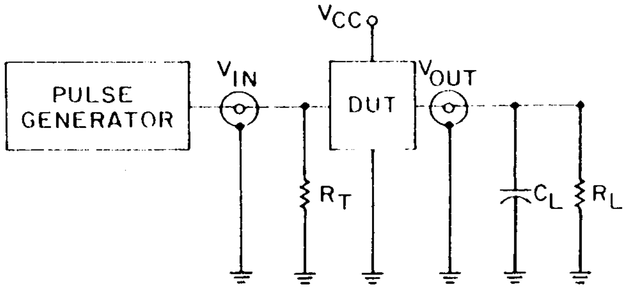
Device types 01 and 02



Definitions:
R_L = Load resistor see ac characteristics for value.
C_L = Load capacitance includes jig and probe capacitance:
See ac characteristics for value.
R_T = Termination should be equal to Z_{OUT} of pulse generators.

FIGURE 4. Switching waveforms and test circuit - Continued.

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, 3, 7, 8, 9, 10, 11
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.

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} and C_{OUT} measurements) 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.

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 = +125C, 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 which SMD's are applicable to that system. DESC will maintain a record of users and this list will be used for coordination and distribution of changes to the drawings. Users of the drawing covering microelectronic 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.

6.6 Approved source of supply. 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-ECS.

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