

REVISIONS

LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED
E	Added to 1.3, 1.4, and table I for device type 01.	92-04-23	<i>[Signature]</i>

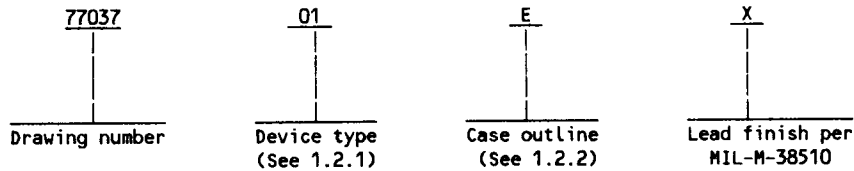
CURRENT CAGE CODE 67268

REV																			
SHEET																			
REV	E																		
SHEET	15																		
REV STATUS OF SHEETS	REV	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
	SHEET	1	2	3	4	5	6	7	8	9	10	11	12	13	14				
PMIC N/A	PREPARED BY MARCIA B. KELLEHER	DEFENSE ELECTRONICS SUPPLY CENTER DAYTON, OHIO 45444																	
<p align="center">STANDARDIZED MILITARY DRAWING</p> <p>THIS DRAWING IS AVAILABLE FOR USE BY ALL DEPARTMENTS AND AGENCIES OF THE DEPARTMENT OF DEFENSE</p> <p>SC N/A</p>	CHECKED BY MONICA L. POELKING	MICROCIRCUIT, DIGITAL, CMOS, 4-BIT MAGNITUDE COMPARATOR, MONOLITHIC SILICON																	
	APPROVED BY MICHAEL A. FRYE																		
	DRAWING APPROVAL DATE 77-09-26	SIZE A	CAGE CODE 14933	77037															
	REVISION LEVEL E	SHEET	1	OF	15	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 or Identifying Number (PIN). The complete PIN shall be as shown in the following example:



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

<u>Device type</u>	<u>Generic number</u>	<u>Circuit function</u>
01	54C85	4-bit magnitude comparator
02	4585B	4-bit magnitude comparator

1.2.2 Case outline(s). The case outline(s) 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
F	F-5 (16 lead, .440" x .285" x .085"), flat package

1.3 Absolute maximum ratings.

Supply voltage range (V_{DD}) device type 01 <u>1/</u> - - - - -	-0.5 V to +15 V
Supply voltage range (V_{DD}) device type 02 <u>1/</u> - - - - -	-0.5 V to +20 V
Input voltage range, device type 01 - - - - -	-0.3 V to $V_{DD} + 0.3$ V
Input voltage range, device type 02 - - - - -	-0.5 V to $V_{DD} + 0.5$ V
Storage temperature range - - - - -	-65°C to +150°C
Maximum power dissipation (P_D) - - - - -	500 mW <u>2/</u>
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
DC input current - - - - -	± 10 mA

1.4 Recommended operating conditions.

Supply voltage range (V_{DD}) device type 01 - - - - -	+3.0 V minimum to +15 V maximum
Supply voltage range (V_{DD}) device type 02 - - - - -	+3.0 V minimum to +18 V maximum
Case operating temperature range - - - - -	-55°C to +125°C

1/ Supply voltages are referenced to the V_{SS} terminal.
2/ For $T_C = +100^\circ\text{C}$, derate linearly at 12 mW/°C to 200 mW.

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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 Case outline(s). The case outline(s) shall be in accordance with 1.2.2 herein.

3.2.2 Terminal connections. The terminal connections shall be as specified on figure 1.

3.2.3 Truth tables. The truth tables shall be as specified on figure 2.

3.2.4 Logic diagrams. The logic diagrams shall be as specified on figure 3.

3.3 Electrical performance characteristics. 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 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.

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TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions -55°C ≤ T _c ≤ +125°C unless otherwise specified		Group A subgroups	Device type	Limits		Unit
						Min	Max	
High-level output voltage	V _{OH}	V _{DD} = 4.5 V	V _{IH} = 3.0 V V _{IL} = 0.8 V I _O = -360 μA	1,2,3	01	2.4		V
		V _{DD} = 5.0 V	V _{IH} = 3.5 V V _{IL} = 1.5 V I _O = -10 μA			4.5		
		V _{DD} = 10 V	V _{IH} = 8.0 V V _{IL} = 2.0 V I _O = -10 μA			9.0		
		V _{DD} = 5 V 1/ V _{DD} = 10 V 1/ V _{DD} = 15 V	V _{IN} = V _{DD} or 0.0 V I _O < 1 μA	1,2,3	02	4.95 9.95 14.95		
Low-level output voltage	V _{OL}	V _{DD} = 4.5 V	V _{IN} = 0.8 V I _O = 360 μA	1,2,3	01		0.4	V
		V _{DD} = 5.0 V	V _{IN} = 1.5 V I _O = 10 μA				0.5	
		V _{DD} = 10 V	V _{IN} = 2.0 V I _O = 10 μA				1.0	
		V _{DD} = 5 V 1/ V _{DD} = 10 V 1/ V _{DD} = 15 V	V _{IN} = V _{DD} or 0, I _O < 1 μA	1,2,3	02	0.05 0.05 0.05		
Low-level input voltage	V _{IL}	V _{DD} = 4.5 V V _{DD} = 5.0 V V _{DD} = 10 V	2/	1,2,3	01		0.8 1.5 2.0	V
		V _O = 4.5 V or 0.5 V	V _{DD} = 5.0 V I _O < 1 μA			1,2,3	02	
		V _O = 9.0 V or 1.0 V	V _{DD} = 10 V 1/ I _O < 1 μA		3.0			
		V _O = 13.5 V or 1.5 V	V _{DD} = 15 V I _O < 1 μA		4.0			

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	Group A subgroups	Device type	Limits		Unit
					Min	Max	
High-level input voltage	V _{IH}	V _{DD} = 4.5 V V _{DD} = 5.0 V V _{DD} = 10 V	2/ 1,2,3	01	3.0		V
					3.5		
					8.0		
		V _O = 4.5 V or 0.5 V			V _{DD} = 5.0 V I _O < 1 μA	1,2,3	
	V _O = 9.0 V or 1.0 V	V _{DD} = 10 V 1/ I _O < 1 μA			7.0		
	V _O = 13.5 V or 1.5 V	V _{DD} = 15 V I _O < 1 μA			11.0		
High-level output current	I _{OH}	V _{DD} = 5.0 V, V _O = 0.0 V, V _{IN} = 0.0 V or V _{DD}	1 2 3	01	-1.75 -1.20 -1.75		mA
		V _{DD} = 10 V, V _O = 0.0 V, V _{IN} = 0.0 V or V _{DD}	1 2 3		-8.0 -5.6 -8.0		
		V _{DD} = 5.0 V, 3/ V _O = 4.6 V, V _{IN} = 0.0 V or V _{DD}	1 2 3	02	-0.51 -0.36 -0.64		
		V _{DD} = 5.0 V, 3/ V _O = 2.5 V, V _{IN} = 0.0 V or V _{DD}	1 2 3		-1.6 -1.15 -2.0		
		V _{DD} = 10 V, 1/ V _O = 9.5 V, V _{IN} = 0.0 V or V _{DD}	1 2 3		-1.3 -0.9 -1.6		
V _{DD} = 15 V, 1/ V _O = 13.5 V, V _{IN} = 0.0 V or V _{DD}	1 2 3		-3.4 -2.4 -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	Group A subgroups	Device type	Limits		Unit	
					Min	Max		
Low-level output current	I _{OL}	V _{DD} = 4.5 V V _O = 0.4 V V _{IN} = 0.0 V or V _{DD}	1	01	0.36		mA	
			2		0.36			
			3		0.36			
		V _{DD} = 5.0 V V _O = 5.0 V V _{IN} = 0.0 V or V _{DD}	1	1.75				
			2	1.20				
			3	1.75				
		V _{DD} = 10 V V _O = 10 V V _{IN} = 0.0 V or V _{DD}	1	8.0				
			2	5.6				
			3	8.0				
		V _{DD} = 5.0 V V _O = 0.4 V V _{IN} = 0.0 V or V _{DD}	3/	1	02	0.51		mA
				2		0.36		
				3		0.64		
V _{DD} = 10 V V _O = 0.5 V V _{IN} = 0.0 V or V _{DD}	1/	1		1.3				
		2		0.9				
		3		1.6				
V _{DD} = 15 V V _O = 1.5 V V _{IN} = 0.0 V or V _{DD}	1/	1		3.4				
		2		2.4				
		3		4.2				
High-level input current	I _{IH}	V _{DD} = 15 V V _{IN} = V _{DD}	1,3	01		0.15	μA	
			2		1.0			
V _{DD} = 20 V V _{IN} = V _{DD}	4/	1,3	02		0.1			
				2	1.0			
Low-level input current	I _{IL}	V _{DD} = 15 V V _{IN} = 0 V	1,3	01	-0.15		μA	
			2		-1.0			
V _{DD} = 20 V V _{IN} = 0.0 V	4/	1,3	02		-0.1			
				2	-1.0			
Input capacitance	C _{IN}	V _{IN} = 0 V See 4.3.1b	4	ALL		7.5	pF	

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	Group A subgroups	Device type	Limits		Unit		
					Min	Max			
Quiescent supply current	I _{DD}	V _{DD} = 15 V V _{IN} = 0.0 V or V _{DD}	1, 3 2	01		10.0 300.0	μA		
		V _{DD} = 5.0 V 1/ V _{IN} = 0.0 V or V _{DD}	1, 3 2	02		5.0 150.0			
		V _{DD} = 10 V 1/ V _{IN} = 0.0 V or V _{DD}	1, 3 2			10.0 300.0			
		V _{DD} = 15 V 1/ V _{IN} = 0.0 V or V _{DD}	1, 3 2			20.0 600.0			
		V _{DD} = 20 V 4/ V _{IN} = 0.0 V or V _{DD}	1, 3 2			100.0 3000.0			
Functional tests		See 4.3.1c	7, 8	ALL					
Propagation delay time, comparing A, B data inputs to data outputs	t _{PHL1} , t _{PLH1}	C _L = 50 pF minimum R _L = 200 kΩ	V _{DD} = 5.0 V V _{DD} = 10 V 1/	9	01	1.5 1.5	600 300	ns	
				10,11		1.5 1.5	750 375		
		C _L = 50 pF, minimum R _L = 200 kΩ t _r = 20 ns t _f = 20 ns	V _{DD} = 5.0 V V _{DD} = 10 V 1/ V _{DD} = 15 V 1/	9	02	1.5 1.5 1.5	600 250 160		
				10,11		1.5 1.5 1.5	780 325 208		
		6/	V _{DD} = 5.0 V V _{DD} = 10 V 1/ V _{DD} = 15 V 1/	10,11			1.5 1.5 1.5		780 325 208
							5/6/		1.5 1.5 1.5

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	Group A subgroups	Device type	Limits		Unit	
					Min	Max		
Propagation delay time, cascading inputs to outputs	t _{PHL2} , t _{PLH2}	C _L = 50 pF minimum R _L = 200 kΩ <u>6/</u>	V _{DD} = 5.0 V V _{DD} = 10 V	9	01	1.5 1.5	500 250	ns
			V _{DD} = 5.0 V V _{DD} = 10 V	10,11		1.5 1.5	625 312	
	t _{PHL2} , t _{PLH2}	C _L = 50 pF, minimum R _L = 200 kΩ t _r = 20 ns t _f = 20 ns <u>5/6/</u>	V _{DD} = 5 V V _{DD} = 10 V <u>1/</u> V _{DD} = 15 V <u>1/</u>	9	02	1.5 1.5 1.5	400 160 120	ns
			V _{DD} = 5 V V _{DD} = 10 V <u>1/</u> V _{DD} = 15 V <u>1/</u>	10,11		1.5 1.5 1.5	520 208 156	
Transition time	t _{PHL1} t _{PLH1}	C _L = 50 pF min, R _L = 200 kΩ, t _r = t _f = 20 ns <u>5/6/</u>	V _{DD} = 5.0 V V _{DD} = 10 V <u>1/</u> V _{DD} = 15 V <u>1/</u>	9	02	1.5 1.5 1.5	200 100 80	ns
			V _{DD} = 5.0 V V _{DD} = 10 V <u>1/</u> V _{DD} = 15 V <u>1/</u>	10,11		1.5 1.5 1.5	260 130 104	

- 1/ This parameter is guaranteed, if not tested, to the specified limits in table I.
- 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/ The I_{OL} and I_{OH} tests are tested 100 percent at T_C = +25°C, and are guaranteed, if not tested, for T_C = -55°C and T_C = +125°C.
- 4/ This test is performed V_{DD} = 18 V at T_C = -55°C.
- 5/ Propagation delay time and transition time tests are performed on a one-input-to-one-output basis only
- 6/ See figure 4 for test circuit and switching waveforms.

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Device type	ALL
Case outlines	E and F
Terminal number	Terminal symbol
1	B2
2	A2
3	A=B <u>1/</u>
4	A>B
5	A<B
6	A=B
7	A1
8	V _{SS}
9	B1
10	A0
11	B0
12	A<B <u>1/</u>
13	A>B <u>1/</u>
14	B3
15	A3
16	V _{DD}

1/ Output pin.

FIGURE 1. Terminal connections.

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Device type 01

INPUTS							OUTPUTS		
COMPARING				CASCADING					
A3, B3	A2, B2	A1, B1	A0, B0	A < B	A = B	A > B	A < B	A = B	A > B
A3 > B3	X	X	X	X	X	X	L	L	H
A3 < B3	X	X	X	X	X	X	H	L	L
A3 = B3	A2 > B2	X	X	X	X	X	L	L	H
A3 = B3	A2 < B2	X	X	X	X	X	H	L	L
A3 = B3	A2 = B2	A1 > B1	X	X	X	X	L	L	H
A3 = B3	A2 = B2	A1 < B1	X	X	X	X	H	L	L
A3 = B3	A2 = B2	A1 = B1	A0 > B0	X	X	X	L	L	H
A3 = B3	A2 = B2	A1 = B1	A0 < B0	X	X	X	H	L	L
A3 = B3	A2 = B2	A1 = B1	A0 = B0	L	L	H	L	L	H
A3 = B3	A2 = B2	A1 = B1	A0 = B0	H	L	L	H	L	L
A3 = B3	A2 = B2	A1 = B1	A0 = B0	L	H	L	L	H	L
A3 = B3	A2 = B2	A1 = B1	A0 = B0	H	H	L	H	H	L
A3 = B3	A2 = B2	A1 = B1	A0 = B0	L	H	H	L	H	H
A3 = B3	A2 = B2	A1 = B1	A0 = B0	H	H	H	H	H	H
A3 = B3	A2 = B2	A1 = B1	A0 = B0	H	L	H	H	L	H
A3 = B3	A2 = B2	A1 = B1	A0 = B0	L	L	L	L	L	L

Device type 02

INPUTS							OUTPUTS		
COMPARING				CASCADING					
A3, B3	A2, B2	A1, B1	A0, B0	A < B	A = B	A > B	A < B	A = B	A > B
A3 > B3	X	X	X	X	X	H	L	L	H
A3 = B3	A2 > B2	X	X	X	X	H	L	L	H
A3 = B3	A2 = B2	A1 > B1	X	X	X	H	L	L	H
A3 = B3	A2 = B2	A1 = B1	A0 > B0	X	X	H	L	L	H
A3 = B3	A2 = B2	A1 = B1	A0 = B0	L	L	H	L	L	H
A3 = B3	A2 = B2	A1 = B1	A0 = B0	L	H	X	L	H	L
A3 = B3	A2 = B2	A1 = B1	A0 = B0	H	L	X	H	L	L
A3 = B3	A2 = B2	A1 = B1	A0 < B0	X	X	X	H	L	L
A3 = B3	A2 = B2	A1 < B1	X	X	X	X	H	L	L
A3 = B3	A2 < B2	X	X	X	X	X	H	L	L
A3 < B3	X	X	X	X	X	X	H	L	L

H = High voltage level, L = Low level voltage level, X = Irrelevant

FIGURE 2. Truth tables.

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Device type 01

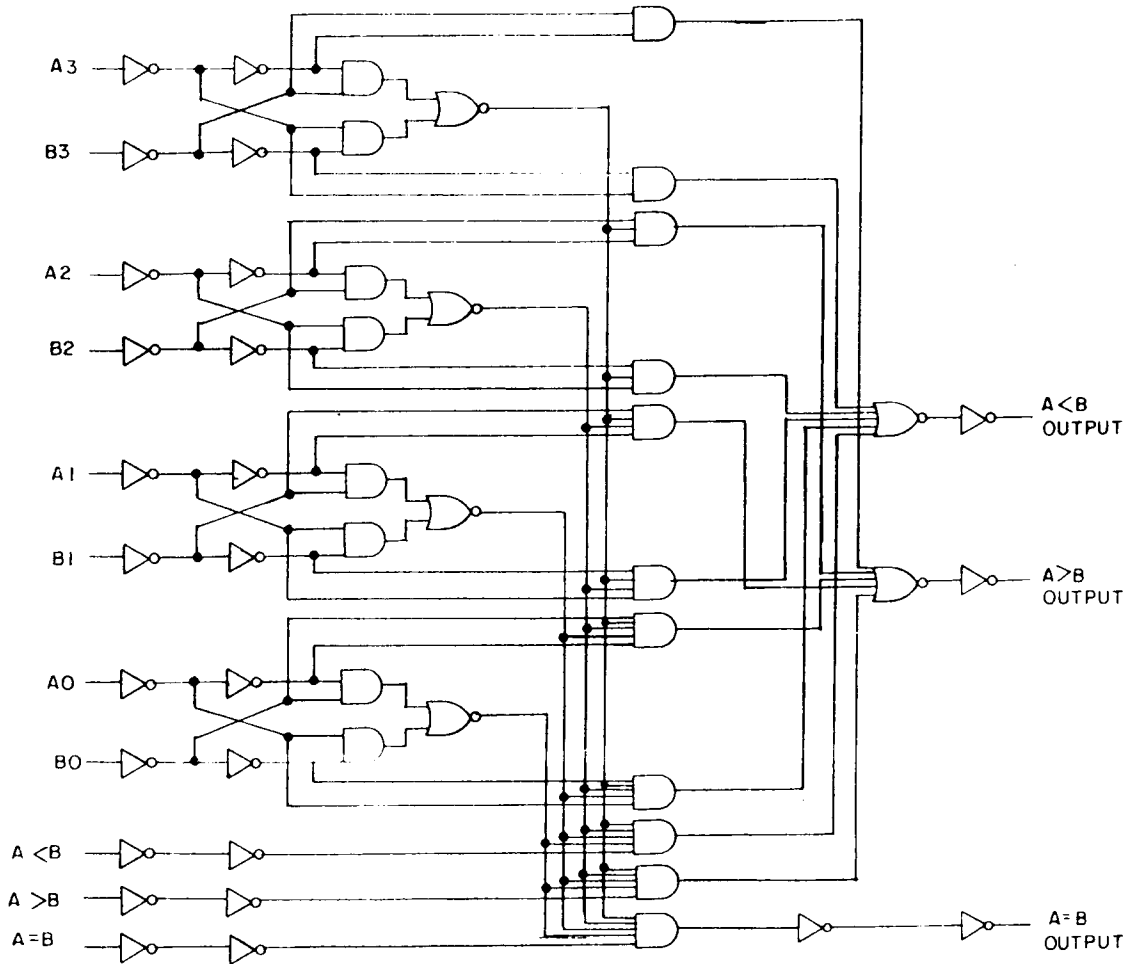


FIGURE 3. Logic diagrams.

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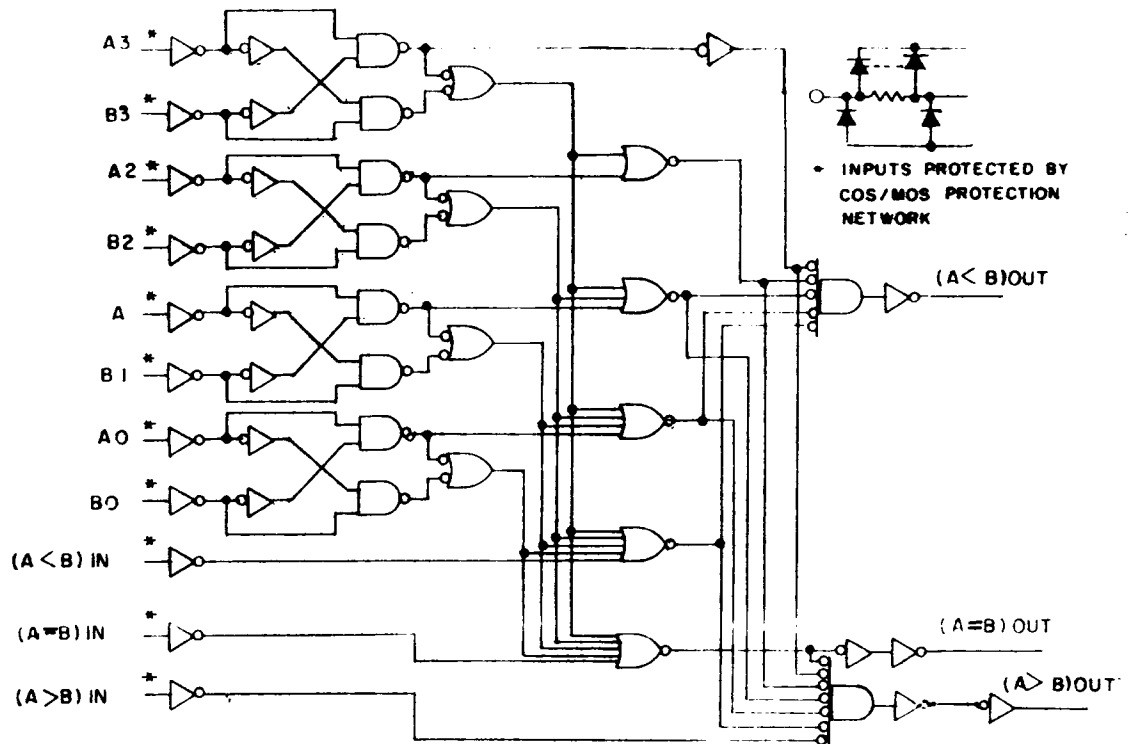
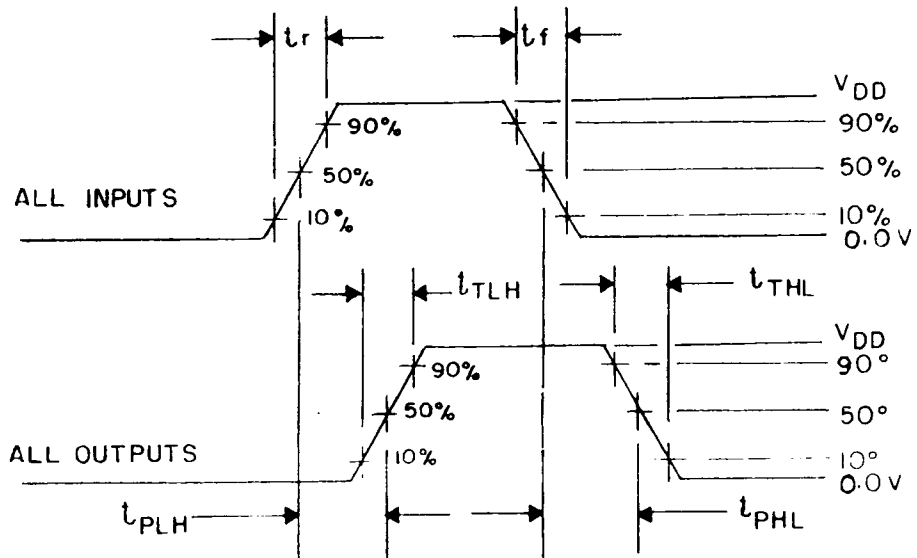
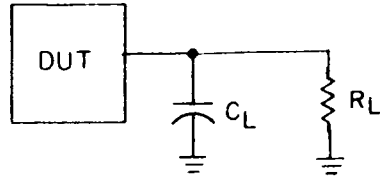


FIGURE 3. Logic diagrams - Continued.

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NOTES:

1. $C_L = 50$ pF, includes probe and jig capacitance.
2. $t_r, t_f = 20$ ns.
3. $R_L = 200$ k Ω .

FIGURE 4. Test circuit and switching waveforms.

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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-ECC 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-ECC 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) $T_A = +125^{\circ}\text{C}$, 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, 3, 7, 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 limits specified in table I.

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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. Subgroup 4 (C_{IN} measurement) shall be measured only for the initial test and after process or design changes which may affect input capacitance. Capacitance shall be measured between the designated terminal and V_{SS} at a frequency of 1 MHz. Test all applicable pins on 5 devices with zero failures.
- c. Subgroups 7 and 8 tests shall verify the truth table as shown 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) $T_A = +125^\circ\text{C}$, 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-ECT, telephone (513) 296-6047.

6.5 Comments. Comments on this drawing should be directed to DESC-ECC, Dayton, Ohio 45444, or telephone (513) 296-8525.

6.6 Approved sources 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-ECC.

STANDARDIZED MILITARY DRAWING DEFENSE ELECTRONICS SUPPLY CENTER DAYTON, OHIO 45444	SIZE A		77037
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