

QUALIFICATION
REQUIREMENTS
REMOVED

MIL-M-38510/162A
9 August 1983
SUPERSEDING
MIL-M-38510/162(USAF)
2 August 1976

MILITARY SPECIFICATION
MICROCIRCUITS, DIGITAL, TTL, NOR BUFFERS,
MONOLITHIC SILICON

INACTIVE FOR NEW DESIGN AFTER DATE OF THIS REVISION

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the detail requirements for monolithic silicon, TTL, NOR buffer microcircuits. One product assurance class and a choice of case outlines and lead finishes are provided and are reflected in the complete part number.

1.2 Part number. The part number shall be in accordance with MIL-M-38510, with the exception that the "JAN" or "J" certification shall not be used.

1.2.1 Device type. The device type shall be as follows:

<u>Device type</u>	<u>Circuit</u>
01	Quadruple, 2-input positive NOR buffer

1.2.2 Device class. The device class shall be the product assurance level as defined in MIL-M-38510.

1.2.3 Case outline. The case outline shall be designated as follows:

<u>Outline letter</u>	<u>Case outline (see MIL-M-38510, appendix C)</u>
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

1.3 Absolute maximum ratings.

Supply voltage range - - - - -	-0.5 V dc to +7.0 V dc
Input voltage range- - - - -	-1.5 V dc at -12 mA to +5.5 V dc
Storage temperature range- - - - -	-65°C to +150°C
Maximum power dissipation, (P _D) ^{1/} - - - - -	315 mW dc
Lead temperature (soldering, 10 ⁻ seconds) - - - - -	+300°C
Thermal resistance, junction-to-case (θ _{JC}):	
Cases A, B, and D- - - - -	0.09°C/mW
Case C - - - - -	0.08°C/mW
Junction temperature (T _J)- - - - -	+175°C

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

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Rome Air Development Center (RBE-2), Griffiss AFB, NY 13441, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

1.4 Recommended operating conditions.

Supply voltage range (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}) -	0.8 V dc
Normalized fanout (each output) <u>2/</u> :	
Low logic level - - - - -	30 maximum
High logic level - - - - -	60 maximum
Case operating temperature range (T_C) -	-55°C to +125°C

2. APPLICABLE DOCUMENTS

2.1 Government specifications and standards. Unless otherwise specified, the following specifications and standards, 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 specification 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 specifications, standards, handbooks, drawings, and publications required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.2 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

3. REQUIREMENTS

3.1 Detail specification. The individual item requirements shall be in accordance with MIL-M-38510, and as specified herein.

3.2 Design, construction, and physical dimensions. The design, construction, and physical dimensions shall be in accordance with MIL-M-38510 and as specified herein.

3.2.1 Logic diagrams and terminal connections. The logic diagrams and terminal connections shall be as specified on figure 1.

3.2.2 Truth table and logic equation. The truth table and logic equation shall be as specified on figure 2.

3.2.3 Case outlines. Case outlines shall be as specified in MIL-M-38510 and in 1.2.3 herein.

3.3 Lead material and finish. The lead material and finish shall be in accordance with MIL-M-38510 (see 6.5).

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

3.5 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 III.

2/ Device will fanout in both high and low levels to the specified number of inputs of the same device type as that being tested.

TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions $-55^{\circ}\text{C} \leq T_C \leq +125^{\circ}\text{C}$ ^{1/}	Min	Max	Unit
High-level output voltage	V_{OH}	$V_{CC} = 4.5\text{ V}$, $V_{IN} = 0.8\text{ V}$ $I_{OH} = -2.4\text{ mA}$ ^{1/}	2.4		V
Low-level output voltage	V_{OL}	$V_{CC} = 4.5\text{ V}$, $I_{OL} = 48\text{ mA}$ $V_{IN} = +2.0\text{ V}$ for all inputs of gate under test ^{2/}		0.4	V
Input clamp voltage	V_{IC}	$V_{CC} = 4.5\text{ V}$, $I_{IN} = -12\text{ mA}$ $T_A = +25^{\circ}\text{C}$		-1.5	V
High-level input current	I_{IH1}	$V_{CC} = 5.5\text{ V}$, $V_{IN} = 2.4\text{ V}$ ^{2/}		40	μA
High-level input current	I_{IH2}	$V_{CC} = 5.5\text{ V}$, $V_{IN} = 5.5\text{ V}$ ^{2/}		100	μA
Low-level input current	I_{IL}	$V_{CC} = 5.5\text{ V}$, $V_{IN} = 0.4\text{ V}$ ^{1/}	-.7	-1.6	mA
Short circuit output current	I_{OS}	$V_{CC} = 5.5\text{ V}$ ^{2/,3/}	-70	-180	mA
High-level supply current per buffer	I_{CCH}	$V_{CC} = 5.5\text{ V}$, ^{2/} $V_{IN} = 0\text{ V}$		21	mA
Low-level supply current per buffer	I_{CCL}	$V_{CC} = 5.5\text{ V}$ ^{1/} , $V_{IN} = 5.0\text{ V}$		57	mA
Propagation delay time high-to-low level	t_{PHL}	$C_L = 150\text{ pF} \pm 10\%$ $R_L = 133\Omega \pm 5\%$	3	24	ns
Propagation delay time low-to-high level	t_{PLH}	$C_L = 150\text{ pF} \pm 10\%$ $R_L = 133\Omega \pm 5\%$	3	20	ns

^{1/} All unspecified inputs at +5.5 volts.

^{2/} All unspecified inputs grounded.

^{3/} Not more than one output should be shorted at a time.

3.6 Marking. Marking shall be in accordance with MIL-M-38510 and 1.2 herein. At the option of the manufacturer, marking of the country of origin may be omitted from the body of the microcircuit, but shall be retained on the initial container. The "JAN" or "J" certification mark shall not be used.

3.7 Manufacturer eligibility. To be eligible to supply microcircuits to this specification, a manufacturer shall have a manufacturer certification in accordance with MIL-M-38510 for at least one line. Not necessarily the line producing the device type described herein.

3.8 Certification. Certification in accordance with MIL-M-38510 is not required for this device.

TABLE II. Electrical test requirements.

MIL-STD-883 test requirements	Subgroups (see table III)
	Class B devices
Interim electrical parameters (pre burn-in) (method 5004)	1
Final electrical test parameters (method 5004)	1*,2,3,9
Group A test requirements (method 5005)	1,2,3,9
Groups C and D end-point electrical parameters (method 5005)	1,2,3
Additional electrical subgroups for group C periodic inspections	10,11

*PDA applies to subgroup 1 (see 4.2c).

4. QUALITY ASSURANCE PROVISIONS

4.1 Sampling and inspection. Sampling and inspection procedures shall be in accordance with MIL-M-38510 and methods 5005 and 5007, as applicable, of MIL-STD-883, except as modified 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 D or E, using the circuit shown on figure 3, or equivalent.
 - (2) $T_A = +125^\circ\text{C}$ minimum.
- b. Interim and final electrical test parameters shall be as specified in table II, except interim electrical parameters test prior to burn-in is optional at the discretion of the manufacturer.
- c. The percent defective allowable (PDA) for class B devices shall be 10 percent based on failures from group A, subgroup 1 test after cooldown as final electrical test in accordance with method 5004 of MIL-STD-883, and with no intervening electrical measurements. If interim electrical parameter tests are performed prior to burn-in, failures resulting from pre burn-in screening may be excluded from the PDA. If interim electrical parameter tests prior to burn-in are omitted, then all screening failures shall be included in the PDA. The verified failures of group A, subgroup 1, after burn-in divided by the total number of devices submitted for burn-in in that lot shall be used to determine the percent defective for that lot, and the lot shall be accepted or rejected based on the PDA for the applicable device class.

4.3 Qualification inspection. Qualification inspection is not required.

4.4 Quality conformance inspection. Quality conformance inspection shall be in accordance with MIL-M-38510, and as specified herein. Inspections to be performed shall be those specified in method 5005 of MIL-STD-883 and herein for groups A, B, C, and D inspections (see 4.4.1 through 4.4.4). Generic test data (see 6.6) may be used to satisfy the requirements for groups C and D inspections. Quality conformance inspection shall be completed on the specific devices covered by this specification before they are shipped.

Device type 01

CASES A,B,C & D

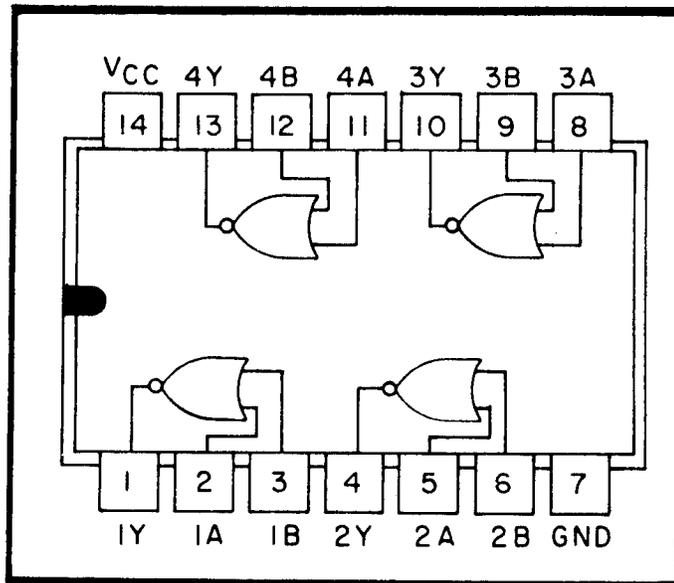


FIGURE 1. Logic diagram and terminal connections (top view).

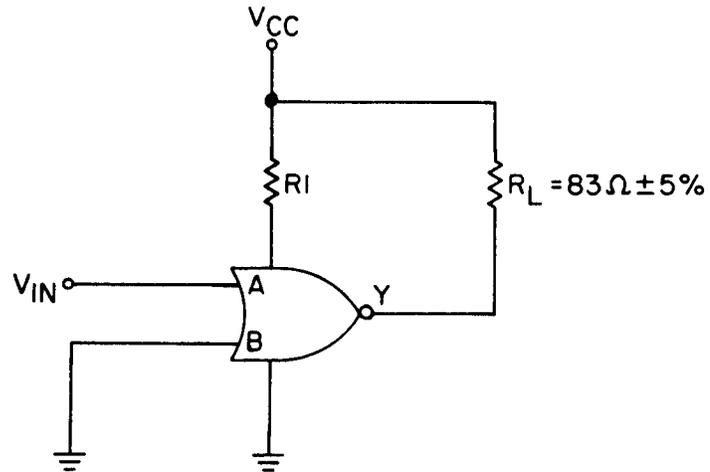
Device type 01

Truth table each gate		
Input		Output
A	B	Y
H	X	L
X	H	L
L	L	H

X = Irrelevant

Positive logic: $Y = \overline{A + B}$

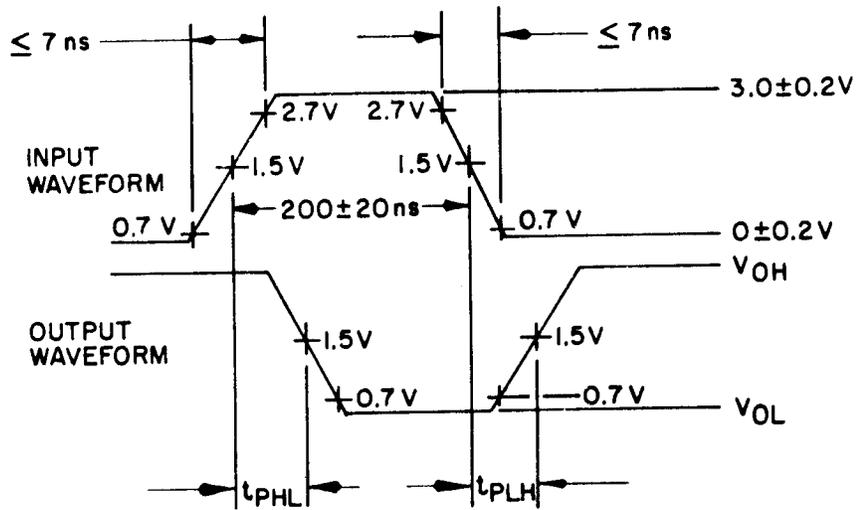
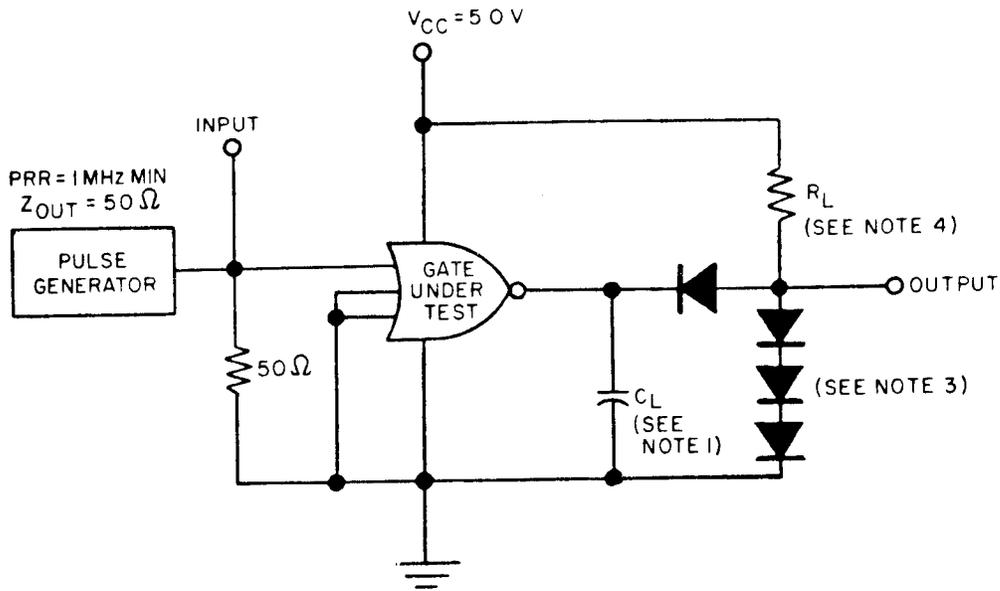
FIGURE 2. Truth table and logic equation.



NOTES:

1. V_{CC} and R_I are such that the minimum voltage at the device terminal is 5 volts.
2. Clock frequency shall be 100 kHz $\pm 50\%$ square wave; duty cycle = 50 $\pm 15\%$;
 $V_{IL} = -0.5$ V to 0.7 V; $V_{IH} = 2.0$ V to 5.5 V.

FIGURE 3. Burn-in and life test circuit.



NOTES:

1. $C_L = 150 \text{ pF} \pm 10\%$ including scope probe, wiring, and stray capacitance, without package in test fixture.
2. Voltage measurements are to be made with respect to network ground terminal.
3. All diodes are 1N3064 or equivalent.
4. $R_L = 133\Omega \pm 5\%$.

FIGURE 4. Switching time test circuit for device type 01.

TABLE III. Group A inspection for device type 01.
Terminal conditions (pins not designated may be $H \geq 2.0$ V, $L \leq 0.8$ V, or open).

Subgroup	Symbol	MIL-STD-883 method	Case A ₁ B ₁ C ₁ D ₁	Terminal conditions														Test limits					
				Test No.	1Y	1A	2	3	4	5	6	7	8	9	10	11	12	13	14	Meas. terminal	Min	Max	Unit
1 $T_c = 25^\circ C$	VOL	3007	1	48 mA	2.0 V	GND	1Y		0.4	V													
			2	48 mA	2.0 V	GND	GND	1Y															
			3		GND	GND	2Y																
			4		GND	GND	2Y																
			5																	3Y			
			6																	3Y			
			7																	3Y			
			8																	4Y			
	VOH	3006	9	-2.4 mA	0.8 V	GND	1Y	2.4															
			10		0.8 V	5.5 V	2Y																
			11		5.5 V	5.5 V	0.8 V	5.5 V	3Y														
			12		5.5 V	4Y																	
			13		GND	GND	1Y	-70	-180	mA													
			14																	2Y			
			15																	3Y			
			16																	4Y			
	I _{H1}	3010	17		2.4 V	GND	1A		40	μ A													
			18		GND	2.4 V	GND	1B															
			19																2A				
			20																2B				
			21																3A				
			22																3B				
			23																4A				
			24																4B				
	I _{H2}	3010	25		5.5 V	GND	1A		100	μ A													
			26		GND	5.5 V	GND	1B															
			27																2A				
			28																2B				
			29																3A				
			30																3B				
			31																4A				
			32																4B				
	I _L	3009	33		0.4 V	5.5 V	1A	-7	-1.6	mA													
			34		5.5 V	0.4 V	5.5 V	1B															
			35																2A				
			36																2B				
			37																3A				
			38																3B				
			39																4A				
			40																4B				
I _{CCH}	3005	41		GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	VCC					
		42		5.0 V	5.0 V	5.0 V	5.0 V	5.0 V	5.0 V	5.0 V	5.0 V	5.0 V	5.0 V	5.0 V	5.0 V	5.0 V	5.0 V	VCC					

TABLE III. Group A inspection for device type 01 - Continued.
Terminal conditions (pins not designated may be H ≥ 2.0 V, L ≤ 0.8 V, or open).

Subgroup	Symbol	MIL-STD-883 method	Case A,B,C,D								Test limits										
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	Meas. terminal	Min	Max	Unit	
1 $T_C = 25^\circ\text{C}$	VTC		43	1Y	1A	1B	2Y	2A	GND	3A	3B	3Y	4A	4B	4Y	VCC	1A				
			44		-12 mA	-12 mA		-12 mA		GND							4.5 V	1B			
			45								-12 mA							2A			
			46									-12 mA						2B			
			47															3A			
			48												-12 mA			3B			
2			49													4A					
			50														4B				
3			Same tests, terminal conditions and limits as for subgroup 1, except $T_A = 125^\circ\text{C}$ and VTC tests are omitted.																		
9 $T_C = 25^\circ\text{C}$	tPHL	3003 (Fig 4)	51	OUT	IN	GND	OUT	IN	GND	IN	GND	OUT	IN	GND	IN	GND	OUT	IN	GND	OUT	
			52																		
			53																		
			54																		
			55	OUT	IN	GND	OUT	IN	GND	OUT	IN	GND	OUT	IN	GND	OUT	IN	GND	OUT	IN	GND
			56																		
			57																		
			58																		
			59	OUT	IN	GND	OUT	IN	GND	OUT	IN	GND	OUT	IN	GND	OUT	IN	GND	OUT	IN	GND
			60																		
			61																		
10 $T_C = 125^\circ\text{C}$	tPLH		62	OUT	IN	GND	OUT	IN	GND	IN	GND	OUT	IN	GND	OUT	IN	GND	OUT	IN	GND	
			63																		
			64																		
			65																		
			66																		
11		Same tests, terminal conditions and limits as for subgroup 10, except $T_A = -55^\circ\text{C}$.																			

4.4.1 Group A inspection. Group A inspection shall be in accordance with table I of method 5005 of MIL-STD-883 and as follows:

- a. Tests shall be as specified in table II herein.
- b. Subgroups 4, 5, 6, 7, and 8 of table I of method 5005 of MIL-STD-883 shall be omitted.

4.4.2 Group B inspection. Group B inspection shall be in accordance with table II of method 5005 of MIL-STD-883. Electrical parameters shall be as specified in table II herein.

4.4.3 Group C inspection. Group C inspection shall be in accordance with table III of method 5005 of MIL-STD-883 and as follows:

- a. End-point electrical test parameters shall be as specified in table II herein.
- b. Subgroups 3 and 4 shall be added to the group C inspection requirements for class B devices and shall consist of the tests, conditions, and limits specified for subgroups 10 and 11 of group A.
- c. Steady-state life test (method 1005 of MIL-STD-883) conditions:
 - (1) Test condition D or E, using the circuit shown on figure 3, or equivalent.
 - (2) $T_A = +125^\circ\text{C}$ minimum.
 - (3) Test duration: 1,000 hours, except as permitted by appendix B of MIL-M-38510.

4.4.4 Group D inspection. Group D inspection shall be in accordance with table IV of method 5005 of MIL-STD-883. End-point electrical parameters shall be as specified in table II herein.

4.5 Methods of inspection. Methods of inspection shall be specified as follows.

4.5.1 Voltage and current. All voltages given are referenced to the microcircuit ground terminal. Currents given are conventional current and positive when flowing into the referenced terminal.

5. PACKAGING

5.1 Packaging requirements. The requirements for packaging of microcircuits shall be in accordance with MIL-M-38510.

6. NOTES

6.1 Notes. The notes specified in MIL-M-38510 are applicable to this specification.

6.2 Intended use. Microcircuits conforming to this specification are intended for logistic support of existing equipment.

6.3 Ordering data. The acquisition document should specify the following:

- a. Complete part number (see 1.2).
- b. Requirements for delivery of one copy of the quality conformance inspection data pertinent to the device inspection lot to be supplied with each shipment by the device manufacturer, if applicable.
- c. Requirements for certificate of compliance, if applicable.
- d. Requirements for notification of change of product or process to the contracting activity, if applicable.

- e. Requirements for packaging and packing.
- f. Requirements for special carriers, lead lengths, or lead forming, if applicable. These requirements shall not affect the part number. Unless otherwise specified, these requirements shall not apply to direct purchase by or direct shipment to the Government.

6.4 Abbreviations, symbols, and definitions. The abbreviations, symbols, and definitions used herein are defined in MIL-M-38510, MIL-STD-1331, and as follows:

GND	- - - - -	Electrical ground (common terminal)
I _{IN}	- - - - -	Current flowing into an input terminal
V _{IN}	- - - - -	Voltage level at an input terminal

6.5 Logistic support. Lead materials and finishes (see 3.3), are interchangeable. Unless otherwise specified, microcircuits acquired for Government logistic support will be acquired to device class B (see 1.2.2) and lead material and finish C (see 3.3). Longer length leads and lead forming shall not affect the part number.

6.6 Generic test data. Generic test data may be used to satisfy the requirements of 4.4.3. Group C generic test data shall be on date codes no more than one year old and on a die in the same microcircuit group (see appendix E of MIL-M-38510) with the same material, design and process and from the same plant as the die represented. Group D (see 4.4.4) generic data shall be on date codes no more than one year old and on the same package type (see terms, definitions, and symbols of MIL-M-38510) and from the same plant as the package represented. The vendor is required to retain the generic data for a period of not less than 36 months from the date of shipment.

6.7 Substitutability. The cross-reference information below is presented for the convenience of users. Microcircuits covered by this specification will functionally replace the listed generic-industry type. Generic-industry microcircuit types may not have equivalent operational performance characteristics across military temperature ranges or reliability factors equivalent to MIL-M-38510 device types and may have slight physical variations in relation to case size. The presence of this information shall not be deemed as permitting substitution of generic-industry types for MIL-M-38510 types or as a waiver of any of the provisions of MIL-M-38510.

<u>Military device type</u>	<u>Generic-industry type</u>
01	5428, 7428

6.8 Ordering guidance. Since the qualification and certification requirements have been removed from the specification, orders may be placed immediately.

6.9 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

Custodians: Army - ER Navy - EC Air Force - 17	Preparing activity: Air Force - 17 (Project 5962-0591-8)
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Review activities:
Army - AR, MI
Navy - OS, SH
Air Force - 11, 19, 85, 99
DLA - ES

User activities:
Army - SM
Navy - AS, CG, MC

Agent:
DLA - ES