REVISIONS

LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED
	"5962-968080lQXA"		

REV																					
SHEET																					
REV																					
SHEET	15	16	17	18	19	20															
REV STATUS OF SHEETS	REV														
	SHEET	1	2	3	4	5	6	7	8	9	10	11	12	13	14

PMIC N/A	PREPARED BY Joseph A. Kerby	DEFENSE ELECTRONICS SUPPLY CENTER DAYTON, OHIO 45444

STANDARD MICROCIRCUIT DRAWING

THIS DRAWING IS AVAILABLE FOR USE BY ALL DEPARTMENTS AND AGENCIES OF THE DEPARTMENT OF DEFENSE

AMSC N/A

CHECKED BY Thanh V. Nguyen

APPROVED BY Ponica L. Poelking

DRAWING APPROVAL DATE 96-02-06

REVISION LEVEL

MICROCIRCUIT, DIGITAL, ADVANCED BIPOLAR CMOS,16-BIT TRI-PORT UNIVERSAL BUS EXCHANGER WITH THREE-STATE OUTPUTS, TTL COMPATIBLE INPUTS, MONOLITHIC SILICON

SIZE A	CAGE CODE 67268	5962-96808

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1. SCOPE

1.1 Scope. This drawing documents two product assurance class levels consisting of high reliability (device classes Q and M) and space application (device class V). A choice of case outlines and lead finishes are available and are reflected in the Part or Identifying Number (PIN). When available, a choice of Radiation Hardness Assurance (RHA) levels are reflected in the PIN.

1.2 PIN. The PIN is as shown in the following example:

```
   5962          -          96808          01          Q          X          X
    |            |            |            |           |          |          |
    |            |            |            |           |          |          |
 Federal       RHA         Device      Device       Case       Lead
 stock class   designator  type        class        outline    finish
 designator    (see 1.2.1) (see 1.2.2) designator   (see 1.2.4)(see 1.2.5)
                                        (see 1.2.3)

 _____  _____/
                     \/
              Drawing number
```
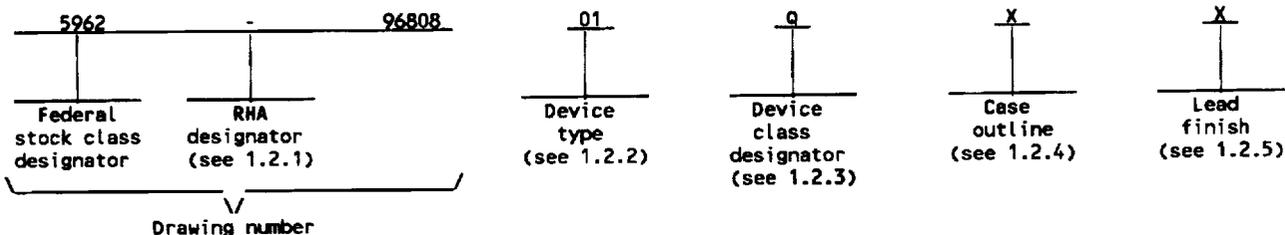
1.2.1 RHA designator. Device classes Q and V RHA marked devices meet the MIL-PRF-38535 specified RHA levels and are marked with the appropriate RHA designator. Device class M RHA marked devices meet the MIL-PRF-38535, appendix A specified RHA levels and are marked with the appropriate RHA designator. A dash (-) indicates a non-RHA device.

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

Device type	Generic number	Circuit function
01	54ABT32316	16-bit tri-port universal bus exchanger with three-state outputs, TTL compatible inputs

1.2.3 Device class designator. The device class designator is a single letter identifying the product assurance level as follows:

Device class	Device requirements documentation
M	Vendor self-certification to the requirements for MIL-STD-883 compliant, non-JAN class level B microcircuits in accordance with MIL-PRF-38535, appendix A
Q or V	Certification and qualification to MIL-PRF-38535

1.2.4 Case outline(s). The case outline(s) are as designated in MIL-STD-1835 and as follows:

Outline letter	Descriptive designator	Terminals	Package style
X	See Figure 1	84	Ceramic quad flatpack

1.2.5 Lead finish. The lead finish is as specified in MIL-PRF-38535 for device classes Q and V or MIL-PRF-38535, appendix A for device class M.

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1.3 Absolute maximum ratings. 1/ 2/ 3/

Supply voltage range (V_CC) . . . . -0.5 V dc to +7.0 V dc
DC input voltage range (I/O ports)(V_{IN}) . . . . -0.5 V dc to +5.5 V dc 4/
DC input voltage range (except I/O ports)(V_{IN}) . . . . -0.5 V dc to +7.0 V dc 4/
DC output voltage range (V_{OUT}) . . . . -0.5 V dc to +5.5 V dc 4/
DC output current (I_{OL}) (per output) . . . . +96 mA
DC input clamp current (I_{IK}) (V_{IN} < 0.0 V) . . . . -18 mA
DC output clamp current (I_{OK}) (V_{OUT} < 0.0 V) . . . . -50 mA
Storage temperature range (T_{STG}) . . . . -65°C to +150°C
Lead temperature (soldering, 10 seconds) . . . . +300°C
Thermal resistance, junction-to-case (θ_{JC}) . . . . 2.4°C/W
Junction temperature (T_J) . . . . +175°C
Maximum power dissipation (P_D) . . . . 642 mW 5/

1.4 Recommended operating conditions. 2/ 3/

Supply voltage range (V_{CC}) . . . . +4.5 V dc to +5.5 V dc
Input voltage range (V_{IN}) . . . . +0.0 V dc to V_{CC}
Output voltage range (V_{OUT}) . . . . +0.0 V dc to V_{CC}
Maximum low level input voltage (V_{IL}) . . . . +0.8 V
Minimum high level input voltage (V_{IH}) . . . . +2.0 V
Maximum high level output current (I_{OH}) . . . . -24 mA
Maximum low level output current (I_{OL}) . . . . +48 mA
Maximum input rise or fall rate ($\Delta t/\Delta V$) . . . . 10 ns/V
Case operating temperature range (T_C) . . . . -55°C to +125°C

1.5 Digital logic testing for device classes Q and V.

Fault coverage measurement of manufacturing
    logic tests (MIL-STD-883, test method 5012) . . . . XX percent   6/

2. APPLICABLE DOCUMENTS

2.1 Government specification, standards, and handbooks. The following specification, standards, and handbooks form
a part of this drawing to the extent specified herein. Unless otherwise specified, the issues of these documents are
those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement
thereto, cited in the solicitation.

SPECIFICATION

  MILITARY

    MIL-PRF-38535 - Integrated Circuits, Manufacturing, General Specification for.

STANDARDS

  MILITARY

    MIL-STD-883   - Test Methods and Procedures for Microelectronics.
    MIL-STD-973   - Configuration Management.
    MIL-STD-1835 - Microcircuit Case Outlines.

1/ Stresses above the absolute maximum rating may cause permanent damage to the device. Extended operation at the
   maximum levels may degrade performance and affect reliability.
2/ Unless otherwise noted, all voltages are referenced to GND.
3/ The limits for the parameters specified herein shall apply over the full specified V_{CC} range and case temperature
   range of -55°C to +125°C.
4/ The input negative voltage rating may be exceeded provided that the input clamp current rating is observed.
5/ Power dissipation values are derived using the formula $P_D = V_{CC}I_{CC} + nV_{OL}I_{OL}$, where V_{CC} and I_{OL} are as specified
   in 1.4 above, I_{CC} and V_{OL} are as specified in table I herein, and n represents the total number of outputs.
6/ Values will be added when they become available.

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MIL-HDBK-103 - List of Standard Microcircuit Drawings (SMD's).
MIL-HDBK-780 - Standard Microcircuit Drawings.

(Unless otherwise indicated, copies of the specification, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2 <u>Order of precedence</u>. In the event of a conflict between the text of this drawing and the references cited herein, the text of this drawing takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 <u>Item requirements</u>. The individual item requirements for device classes Q and V shall be in accordance with MIL-PRF-38535 and as specified herein or as modified in the device manufacturer's Quality Management (QM) plan. The modification in the QM plan shall not affect the form, fit, or function as described herein. The individual item requirements for device class M shall be in accordance with MIL-PRF-38535, appendix A for non-JAN class level B devices and as specified herein.

3.2 <u>Design, construction, and physical dimensions</u>. The design, construction, and physical dimensions shall be as specified in MIL-PRF-38535 and herein for device classes Q and V or MIL-PRF-38535, appendix A and herein for device class M.

3.2.1 <u>Case outline</u>. The case outline shall be in accordance with 1.2.4 herein and figure 1.

3.2.2 <u>Terminal connections</u>. The terminal connections shall be as specified on figure 2.

3.2.3 <u>Truth tables</u>. The truth tables shall be as specified on figure 3.

3.2.4 <u>Logic diagram</u>. The logic diagram shall be as specified on figure 4.

3.2.5 <u>Ground bounce load circuit and waveforms</u>. The ground bounce load circuit and waveforms shall be as specified on figure 5.

3.2.6 <u>Switching waveforms and test circuit</u>. The switching waveforms and test circuit shall be as specified on figure 6.

3.2.7 <u>Radiation exposure circuit</u>. The radiation exposure circuit shall be as specified when available.

3.3 <u>Electrical performance characteristics and postirradiation parameter limits</u>. Unless otherwise specified herein, the electrical performance characteristics and postirradiation parameter limits are as specified in table I and shall apply over the full case operating temperature range.

3.4 <u>Electrical test requirements</u>. The electrical test requirements shall be the subgroups specified in table II. The electrical tests for each subgroup are defined in table I.

3.5 <u>Marking</u>. 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-HDBK-103. For packages where marking of the entire SMD PIN number is not feasible due to space limitations, the manufacturer has the option of not marking the "5962-" on the device. For RHA product using this option, the RHA designator shall still be marked. Marking for device classes Q and V shall be in accordance with MIL-PRF-38535. Marking for device class M shall be in accordance with MIL-PRF-38535, appendix A.

3.5.1 <u>Certification/compliance mark</u>. The certification mark for device classes Q and V shall be a "QML" or "Q" as required in MIL-PRF-38535. The compliance mark for device class M shall be a "C" as required in MIL-PRF-38535, appendix A.

3.6 <u>Certificate of compliance</u>. For device classes Q and V, a certificate of compliance shall be required from a QML-38535 listed manufacturer in order to supply to the requirements of this drawing (see 6.6.1 herein). For device class M, a certificate of compliance shall be required from a manufacturer in order to be listed as an approved source of supply in MIL-HDBK-103 (see 6.6.2 herein). The certificate of compliance submitted to DESC-EC prior to listing as an approved source of supply for this drawing shall affirm that the manufacturer's product meets, for device classes Q and V, the requirements of MIL-PRF-38535 and herein or for device class M, the requirements of MIL-PRF-38535, appendix A and herein.

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		REVISION LEVEL	SHEET 4

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TABLE I. Electrical performance characteristics.

Test and symbol MIL-STD-883 test method 1/		Test conditions 2/ -55°C ≤ T_C ≤ +125°C +4.5 V ≤ V_{CC} ≤ +5.5 V unless otherwise specified		V_{CC}	Group A subgroups	Limits 3/		Unit
						Min	Max	
Negative input clamp voltage 3022	V_{IK}	For input under test I_{IN} = -18 mA		4.5 V	1, 2, 3		-1.2	V
High level output voltage 3006	V_{OH}	For all inputs affecting output under test V_{IN} = 2.0 V or 0.8 V	I_{OH} = -3.0 mA	4.5 V	1, 2, 3	2.5		V
				5.0 V	1, 2, 3	3.0		
			I_{OH} = -24 mA	4.5 V	1, 2, 3	2.0		
Low level output voltage 3007	V_{OL}	For all inputs affecting output under test V_{IN} = 2.0 V or 0.8 V	I_{OL} = 48 mA	4.5 V	1, 2, 3		0.55	V
Input current high 3010	I_{IH}	For input under test V_{IN} = V_{CC}	Control inputs	5.5 V	1, 2, 3		+1.0	μA
	4/		An, Bn, or Cn ports				+100	
Input current low 3009	I_{IL}	For input under test V_{IN} = GND	Control inputs	5.5 V	1, 2, 3		-1.0	μA
	4/		An, Bn, or Cn ports				-100	
Input hold current	$I_{I(hold)}$	An, Bn, or Cn ports	V_I = 0.8 V	4.5 V	1, 2, 3	100		μA
	4/		V_I = 2.0 V			-100		
Three-state output leakage current high 3021	I_{OZH} 5/	For control input affecting output under test, V_{IN} = 2.0 V or 0.8 V V_{OUT} = 2.7 V		5.5 V	1, 2, 3		50	μA
Three-state output leakage current low 3020	I_{OZL} 5/	For control input affecting output under test, V_{IN} = 2.0 V or 0.8 V V_{OUT} = 0.5 V		5.5 V	1, 2, 3		-50	μA
Off-state leakage current	I_{OFF}	For input or output under test V_{IN} or V_{OUT} = 4.5 V All other pins at 0.0 V		0.0 V	1		±100	μA
High-state leakage current	I_{CEX}	For output under test, V_{OUT} = 5.5 V Outputs at high logic state		5.5 V	1, 2, 3		50	μA
Output current 3011	I_O 6/	V_{OUT} = 2.5 V		5.5 V	1, 2, 3	-50	-180	mA
Quiescent supply current 3005	I_{CC}	For all inputs V_{IN} = V_{CC} or GND I_{OUT} = 0 A	Outputs high	5.5 V	1, 2, 3		2.0	mA
			Outputs low				40	
			Outputs disabled				1.0	
Quiescent supply current delta, TTL input level 3005	ΔI_{CC} 7/	For input under test, V_{IN} = 3.4 V For all other inputs, V_{IN} = V_{CC} or GND		5.5 V	1, 2, 3		1.0	mA

See footnotes at end of table.

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TABLE I. __Electrical performance characteristics__ - Continued.

Test and MIL-STD-883 test method 1/	Symbol	Test conditions 2/ -55°C ≤ T_C ≤ +125°C +4.5 V ≤ V_{CC} ≤ +5.5 V unless otherwise specified		V_{CC}	Group A subgroups	Limits 3/ Min	Limits 3/ Max	Unit
Input capacitance 3012	C_{IN}	T_C = +25°C, V_{IN} = 2.5 V or 0.5 V See 4.4.1c	Control inputs	5.0 V	4		5.0	pF
I/O capacitance 3012	$C_{I/O}$		An, Bn, or Cn ports	5.0 V	4		15.0	pF
Low level ground bounce noise	V_{OLP} 8/	V_{IH} = 3.0 V, V_{IL} = 0.0 V T_C = +25°C See figure 5 See 4.4.1d		5.0 V	4		1600	mV
	V_{OLV} 8/			5.0 V	4		-1350	mV
High level V_{CC} bounce noise	V_{OHP} 8/			5.0 V	4		1650	mV
	V_{OHV} 8/			5.0 V	4		-700	mV
Functional test	9/	V_{IH} = 2.0 V, V_{IL} = 0.8 V Verify output V_O See 4.4.1b		4.5 V	7, 8	L	H	
				5.5 V	7, 8	L	H	
Clock frequency	f_{clock}	C_L = 50 pF minimum, R_L = 500Ω, See figure 6		4.5 V and 5.5 V	9, 10, 11	0	150	MHz
Pulse duration	t_W	C_L = 50 pF minimum, R_L = 500Ω, See figure 6	LEx high	4.5 V and 5.5 V	9, 10, 11	3.3		ns
			CLKx high or low					
Setup time, high or low	t_s	C_L = 50 pF minimum, R_L = 500Ω, See figure 6	An, Bn, or Cn before CLKx↑	4.5 V and 5.5 V	9, 10, 11	2.6		ns
			An or Bn before LEx↓			2.5		
			$\overline{CLKEN}$x before CLKx↑			3.5		
Hold time, high or low	t_h	C_L = 50 pF minimum, R_L = 500Ω, See figure 6	An, Bn, or Cn after CLKx↑	4.5 V and 5.5 V	9, 10, 11	1.8		ns
			An or Bn after LEx↓			2.4		
			$\overline{CLKEN}$x after CLKx↑			1.5		
Maximum operating frequency	f_{MAX} 10/	C_L = 50 pF minimum, R_L = 500Ω, See figure 6		4.5 V and 5.5 V	9, 10, 11	150		MHz
Propagation delay time, An, Bn, or Cn to Cn, Bn, or An 3003	t_{PLH1} 10/	C_L = 50 pF minimum, R_L = 500Ω, See figure 6		4.5 V and 5.5 V	9, 10, 11	0.8	6.5	ns
	t_{PHL1} 10/			4.5 V and 5.5 V	9, 10, 11	0.5	6.8	

See footnotes at end of table.

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

Test and MIL-STD-883 test method 1/	Symbol	Test conditions 2/ -55°C ≤ T_C ≤ +125°C +4.5 V ≤ V_{CC} ≤ +5.5 V unless otherwise specified	V_{CC}	Group A subgroups	Limits 3/ Min	Limits 3/ Max	Unit
Propagation delay time, SELx to Cn, Bn or An 3003	t_{PLH2} 10/	C_L = 50 pF minimum, R_L = 500Ω, See figure 6	4.5 V and 5.5 V	9, 10, 11	0.8	6.7	ns
	t_{PHL2} 10/		4.5 V and 5.5 V	9, 10, 11	0.8	6.8	
Propagation delay time, LEx to Cn, Bn or An 3003	t_{PLH3} 10/	C_L = 50 pF minimum, R_L = 500Ω, See figure 6	4.5 V and 5.5 V	9, 10, 11	1.5	8.0	ns
	t_{PHL3} 10/		4.5 V and 5.5 V	9, 10, 11	1.5	7.4	
Propagation delay time, CLKx to Cn, Bn or An 3003	t_{PLH4} 10/	C_L = 50 pF minimum, R_L = 500Ω, See figure 6	4.5 V and 5.5 V	9, 10, 11	1.5	8.0	ns
	t_{PHL4} 10/		4.5 V and 5.5 V	9, 10, 11	1.5	7.2	
Propagation delay time, output enable, $\overline{OE}$x to Cn, Bn or An 3003	t_{PZH} 10/	C_L = 50 pF minimum, R_L = 500Ω, See figure 6	4.5 V and 5.5 V	9, 10, 11	0.8	6.7	ns
	t_{PZL} 10/		4.5 V and 5.5 V	9, 10, 11	1.5	7.1	
Propagation delay time, output disable, $\overline{OE}$x to Cn, Bn or An 3003	t_{PHZ} 10/	C_L = 50 pF minimum, R_L = 500Ω, See figure 6	4.5 V and 5.5 V	9, 10, 11	0.8	7.2	ns
	t_{PLZ} 10/		4.5 V and 5.5 V	9, 10, 11	0.8	6.4	

1/ For tests not listed in the referenced MIL-STD-883 (e.g. ΔI_{CC}), utilize the general test procedure of 883 under the conditions listed herein.

2/ Each input/output, as applicable, shall be tested at the specified temperature, for the specified limits, to the tests in table I herein. Output terminals not designated shall be high level logic, low level logic, or open, except for all I_{CC} and ΔI_{CC} tests, where the output terminals shall be open. When performing these tests, the current meter shall be placed in the circuit such that all current flows through the meter. For input terminals not designated, V_{IN} = GND or V_{IN} ≥ 3.0 V.

3/ For negative and positive voltage and current values, the sign designates the potential difference in reference to GND and the direction of current flow, respectively, and the absolute value of the magnitude, not the sign, is relative to the minimum and maximum limits, as applicable, listed herein. All devices shall meet or exceed the limits specified in table I at 4.5 V ≤ V_{CC} ≤ 5.5 V.

4/ For I/O ports, the limit includes I_{OZH} or I_{OZL} leakage current from the output circuitry.

5/ For I/O ports, the limit includes I_{IH} or I_{IL} leakage current from the input circuitry. This test shall be guaranteed, if not tested, to the limits specified in table I herein, when performed with control inputs that affect the state of the output under test at V_{IN} = 0.8 V or 2.0 V.

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

6/ Not more than one output should be tested at one time, and the duration of the test condition should not exceed one second.

7/ This is the increase in supply current for each input that is at one of the specified TTL voltage levels rather than 0 V or V_{CC}. This test may be performed either one input at a time (preferred method) or with all input pins simultaneously at $V_{IN} = V_{CC} - 2.1$ V (alternate method). When the test is performed using the alternate test method, the maximum limit is equal to the number of inputs at a high TTL input level times ΔI_{CC} maximum, and the preferred method and limits are guaranteed.

8/ This test is for qualification only. Ground and V_{CC} bounce tests are performed on a non-switching (quiescent) output and are used to measure the magnitude of induced noise caused by other simultaneously switching outputs. The test is performed on a low noise bench test fixture. For the device under test, all outputs shall be loaded with 500Ω of load resistance and a minimum of 50 pF of load capacitance (see figure 5). Only chip capacitors and resistors shall be used. The output load components shall be located as close as possible to the device outputs. It is suggested, that whenever possible, this distance be kept to less than 0.25 inches. Decoupling capacitors shall be placed in parallel from V_{CC} to ground. The values of these decoupling capacitors shall be determined by the device manufacturer. The low and high level ground and V_{CC} bounce noise is measured at the quiet output using a 1 GHz minimum bandwidth oscilloscope with a 50Ω input impedance.

The device inputs shall be conditioned such that all outputs are at a high nominal V_{OH} level. The device inputs shall then be conditioned such that they switch simultaneously and the output under test remains at V_{OH} as all other outputs possible are switched from V_{OH} to V_{OL}. V_{OHV} and V_{OHP} are then measured from the nominal V_{OH} level to the largest negative and positive peaks, respectively (see figure 5). This is then repeated with the same outputs not under test switching from V_{OL} to V_{OH}.

The device inputs shall be conditioned such that all outputs are at a low nominal V_{OL} level. The device inputs shall then be conditioned such that they switch simultaneously and the output under test remains at V_{OL} as all other outputs possible are switched from V_{OL} to V_{OH}. V_{OLP} and V_{OLV} are then measured from the nominal V_{OL} level to the largest positive and negative peaks, respectively (see figure 5). This is then repeated with the same outputs not under test switching from V_{OH} to V_{OL}.

9/ Tests shall be performed in sequence, attributes data only. Functional tests shall include the truth tables and other logic patterns used for fault detection. The test vectors used to verify the truth tables shall, at a minimum, test all functions of each input and output. All possible input to output logic patterns per function shall be guaranteed, if not tested, to the truth tables in figure 3 herein. Functional tests shall be performed in sequence as approved by the qualifying activity on qualified devices. After incorporating allowable tolerances per MIL-STD-883, $V_{IL} = 0.4$ V and $V_{IH} = 2.4$ V. For outputs, L ≤ 0.8 V, H ≥ 2.0 V.

10/ For propagation delay tests, test all functions of each input and output.

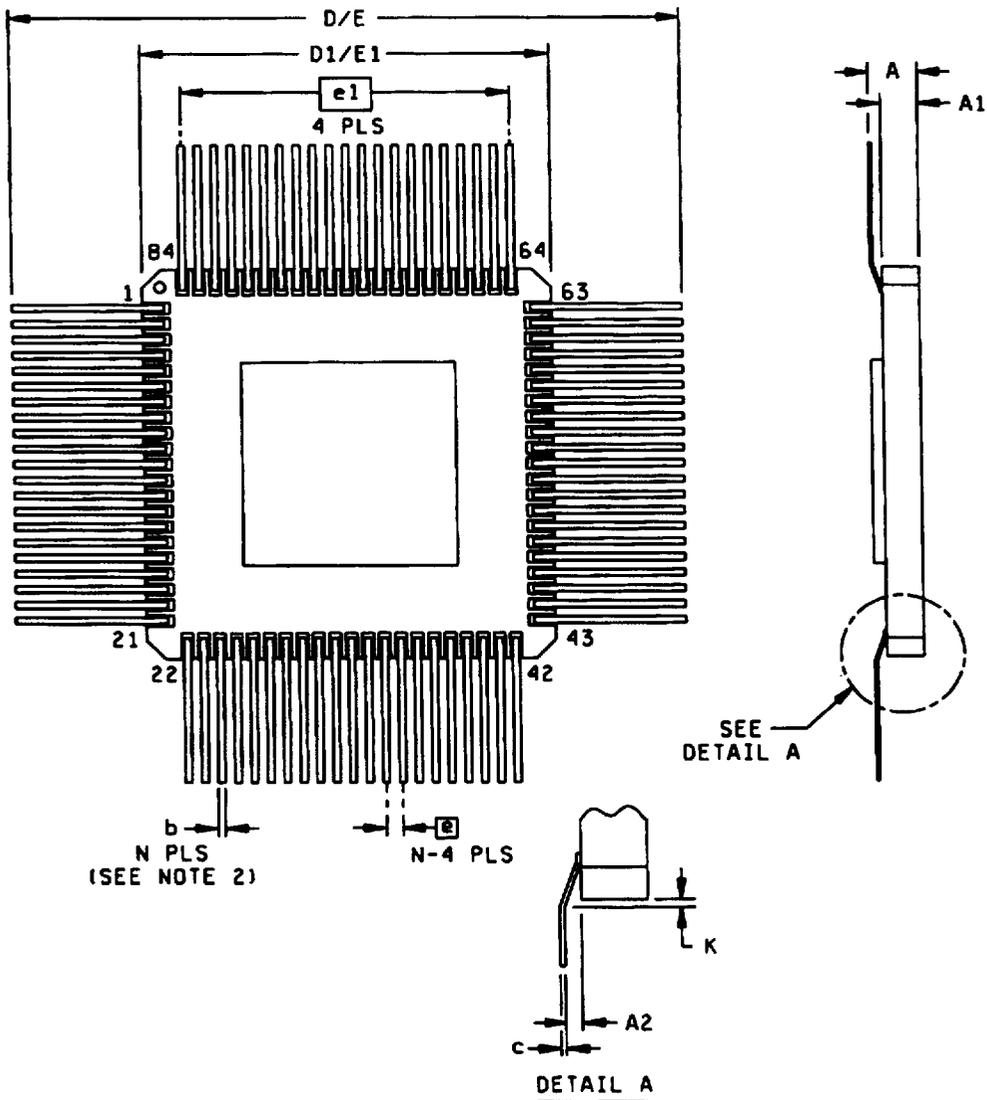|	SIZE **A**		**5962-96808**
STANDARD MICROCIRCUIT DRAWING DEFENSE ELECTRONICS SUPPLY CENTER DAYTON, OHIO 45444		REVISION LEVEL	SHEET **8**

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Case X

FIGURE 1. Case outline.

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Symbol	Millimeters		Inches	
	Min	Max	Min	Max
A	---	3.30	---	0.130
A1	---	2.67	---	0.105
A2	0.05	0.36	0.002	0.014
D/E	36.07	37.21	1.420	1.465
D1/E1	16.13	16.89	0.635	0.665
N	84		84	
e	0.64 BSC		0.025 BSC	
e1	12.70 BSC		0.500 BSC	
b	0.152	0.305	0.006	0.012
c	0.1	0.2	0.004	0.008
K	---	0.46	---	0.018

NOTES:

1. The US government preferred system of measurement is the metric SI system. However, this item is originally designed using inch-pound unit of measurement. In the event of conflict between the metric and inch-pound units, the inch-pound units shall take precedence.

2. N is the maximum number of terminals.

3. A terminal 1 identification mark shall be located next to pin 1 at the corner of the package. Terminal numbers shall increase in a counterclockwise direction when viewed as shown.

FIGURE 1. Case outline - Continued.

STANDARD **MICROCIRCUIT DRAWING** **DEFENSE ELECTRONICS SUPPLY CENTER** **DAYTON, OHIO 45444**	SIZE **A**	**5962-96808**
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Device type		01	
Case outline		X	
Terminal number	Terminal symbol	Terminal number	Terminal symbol
1	A2	43	B9
2	A3	44	B10
3	A4	45	B11
4	GND	46	GND
5	A5	47	B12
6	A6	48	B13
7	A7	49	B14
8	A8	50	B15
9	A9	51	B16
10	V_{CC}	52	GND
11	NC	53	NC
12	GND	54	V_{CC}
13	A10	55	C1
14	A11	56	C2
15	A12	57	C3
16	A13	58	C4
17	A14	59	C5
18	GND	60	GND
19	A15	61	C6
20	A16	62	C7
21	NC	63	C8
22	$\overline{CLKENA}$	64	C9
23	CLKA	65	C10
24	$\overline{LEA}$	66	C11
25	$\overline{OEB}$	67	GND
26	SELB	68	C12
27	LEB	69	C13
28	$\overline{CLKB}$	70	C14
29	$\overline{CLKENB}$	71	C15
30	NC	72	C16
31	V_{CC}	73	GND
32	NC	74	NC
33	GND	75	V_{CC}
34	B1	76	NC
35	B2	77	$\overline{CLKENC}$
36	B3	78	CLKC
37	B4	79	LEC
38	B5	80	$\overline{SELC}$
39	GND	81	$\overline{OEC}$
40	B6	82	$\overline{OEA}$
41	B7	83	SELA
42	B8	84	A1

NC = No connection

Terminal symbol	Terminal description
An (n = 1 to 16)	A data register
Bn (n = 1 to 16)	B data register
Cn (n = 1 to 16)	C data register
$\overline{OE}$x (x = A, B, or C)	Output enable control inputs
SELx (x = A, B, or C)	Select control inputs
LEx (x = A, B, or C)	Latch enable control inputs
CLKx (x = A, B, or C)	Clock inputs
$\overline{CLKEN}$x (x = A, B, or C)	Clock enable inputs

FIGURE 2. Terminal connections.

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Storage function table

Inputs 1/				Outputs
$\overline{CLKEN}x$	CLKx	LEx	x	
H	X	L	X	Q_0
L	↑	L	L	L
L	↑	L	H	H
X	H	L	X	Q_0
X	L	L	X	Q_0
X	X	H	L	L
X	X	H	H	H

1/ x = A, B, or C register

A-port output

Inputs		Outputs
$\overline{OEA}$	SELA	An
H	X	Z
L	H	Output of C register
L	L	Output of B register

B-port output

Inputs		Outputs
$\overline{OEB}$	SELB	Bn
H	X	Z
L	H	Output of A register
L	L	Output of C register

C-port output

Inputs		Outputs
$\overline{OEC}$	SELC	Cn
H	X	Z
L	H	Output of B register
L	L	Output of A register

H = High voltage level
L = Low voltage level
X = Irrelevant
Z = Disabled
↑ = Low-to-high transition of clock.
Q_0 = The level of Q before the indicated steady-
    state input conditions were established.

FIGURE 3. Truth tables.

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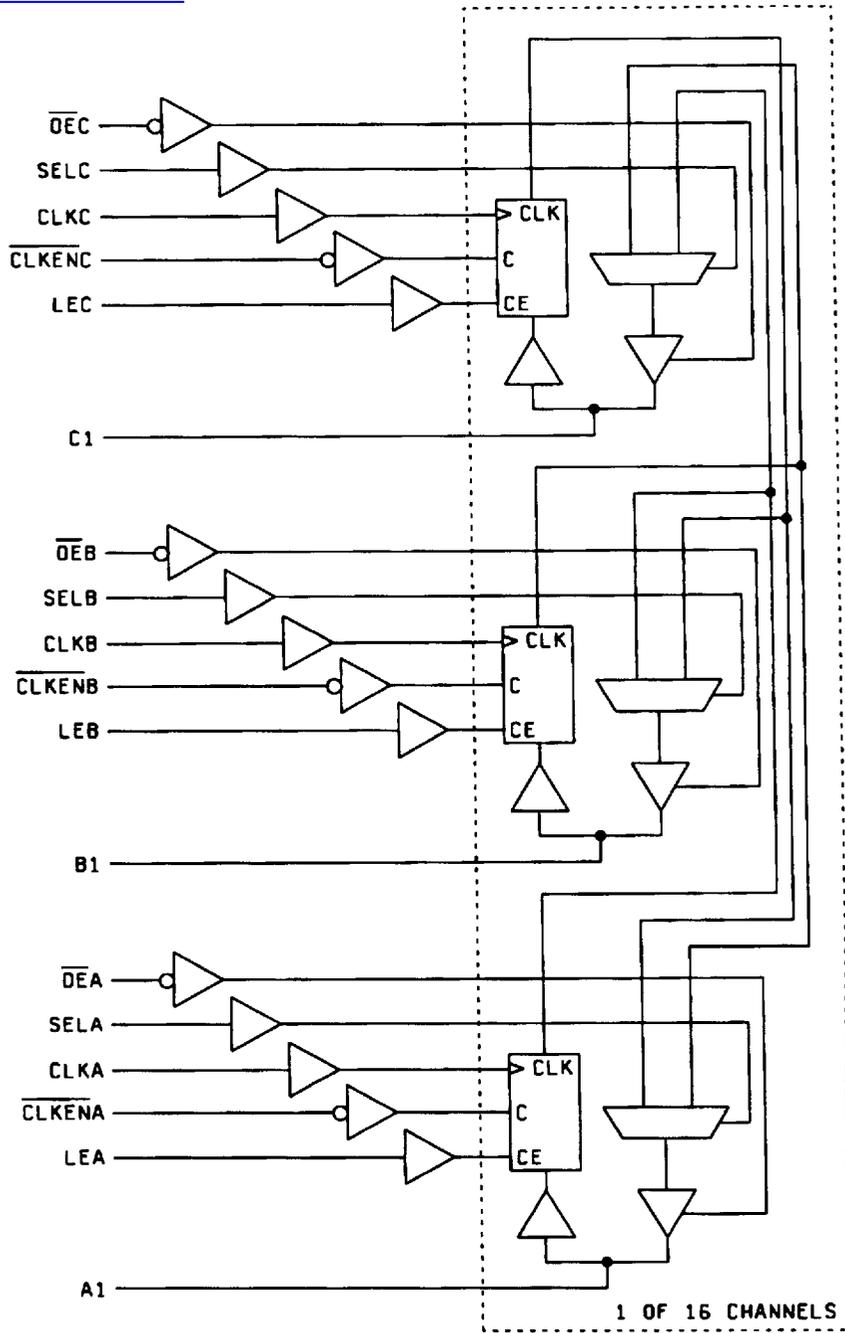
FIGURE 4. Logic diagram.

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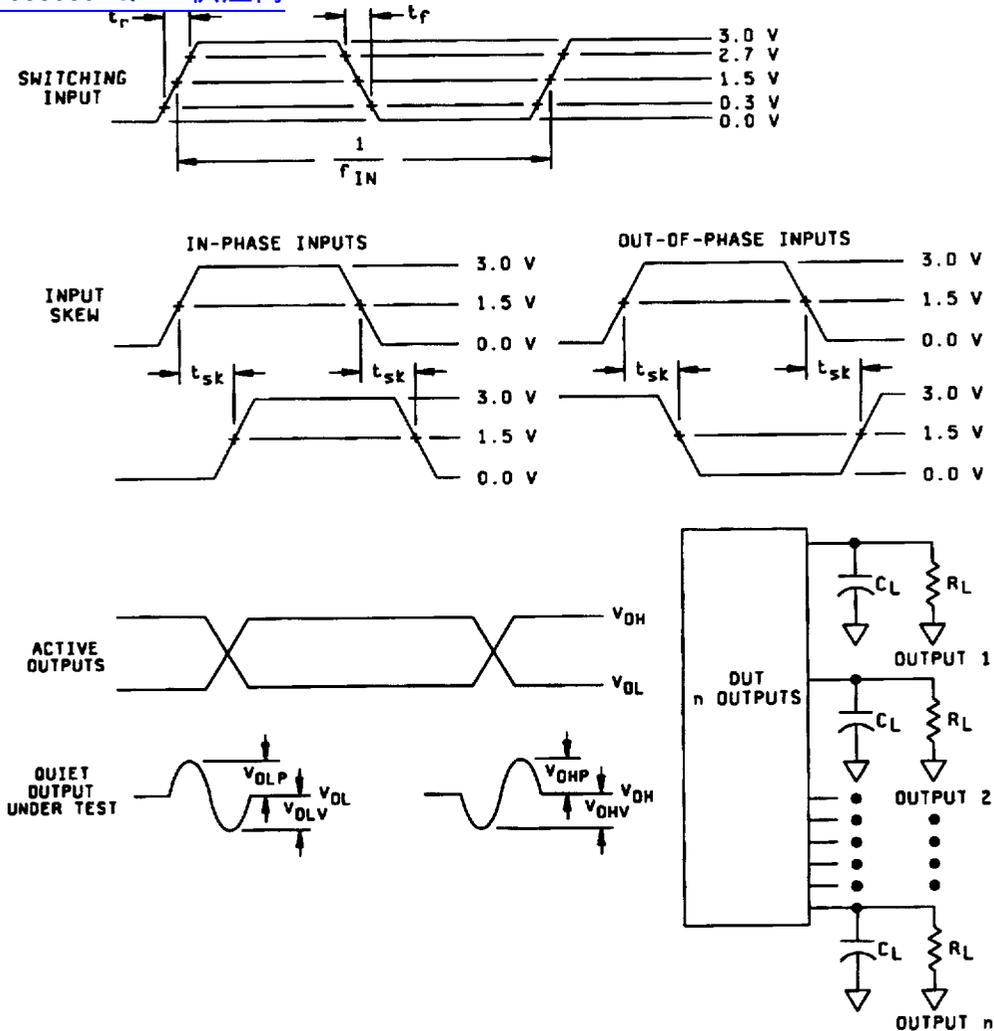
NOTES:
1. C_L includes a 47 pF chip capacitor (-0 percent, +20 percent) and at least 3 pF of equivalent capacitance from the test jig and probe.
2. R_L = 450Ω ±1 percent, chip resistor in series with a 50Ω termination. For monitored outputs, the 50Ω termination shall be the 50Ω characteristic impedance of the coaxial connector to the oscilloscope.
3. Input signal to the device under test:
   a. V_{IN} = 0.0 V to 3.0 V; duty cycle = 50 percent; f_{IN} ≥ 1 MHz.
   b. t_r, t_f = 3 ns ±1.0 ns. For input signal generators incapable of maintaining these values of t_r and t_f, the 3.0 ns limit may be increased up to 10 ns, as needed, maintaining the ±1.0 ns tolerance and guaranteeing the results at 3.0 ns ±1.0 ns; skew between any two switching inputs signals (t_{sk}): ≤ 250 ps.

FIGURE 5. Ground bounce load circuit and waveforms.

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TIMING INPUT — 1.5 V — 3.0 V / 0.0 V

t_s — t_h

DATA INPUT — 1.5 V — 1.5 V — 3.0 V / 0.0 V

INPUT PULSE
WIDTH HIGH
AND LOW — t_w — 3.0 V / 1.5 V / 0.0 V

CLKx
INPUT — $\frac{1}{f_{MAX}}$ — 3.0 V / 1.5 V / 0.0 V

t_{PLH} — t_{PHL}

An,Bn,OR Cn
OUTPUT — V_{OH} / 1.5 V / V_{OL}

LEx INPUT — 3.0 V / 1.5 V / 0.0 V

t_{PLH}

Cn,Bn,OR An
OUTPUT — V_{OH} / 1.5 V / V_{OL}

t_{PHL}

Cn,Bn,OR An
OUTPUT — V_{OH} / 1.5 V / V_{OL}
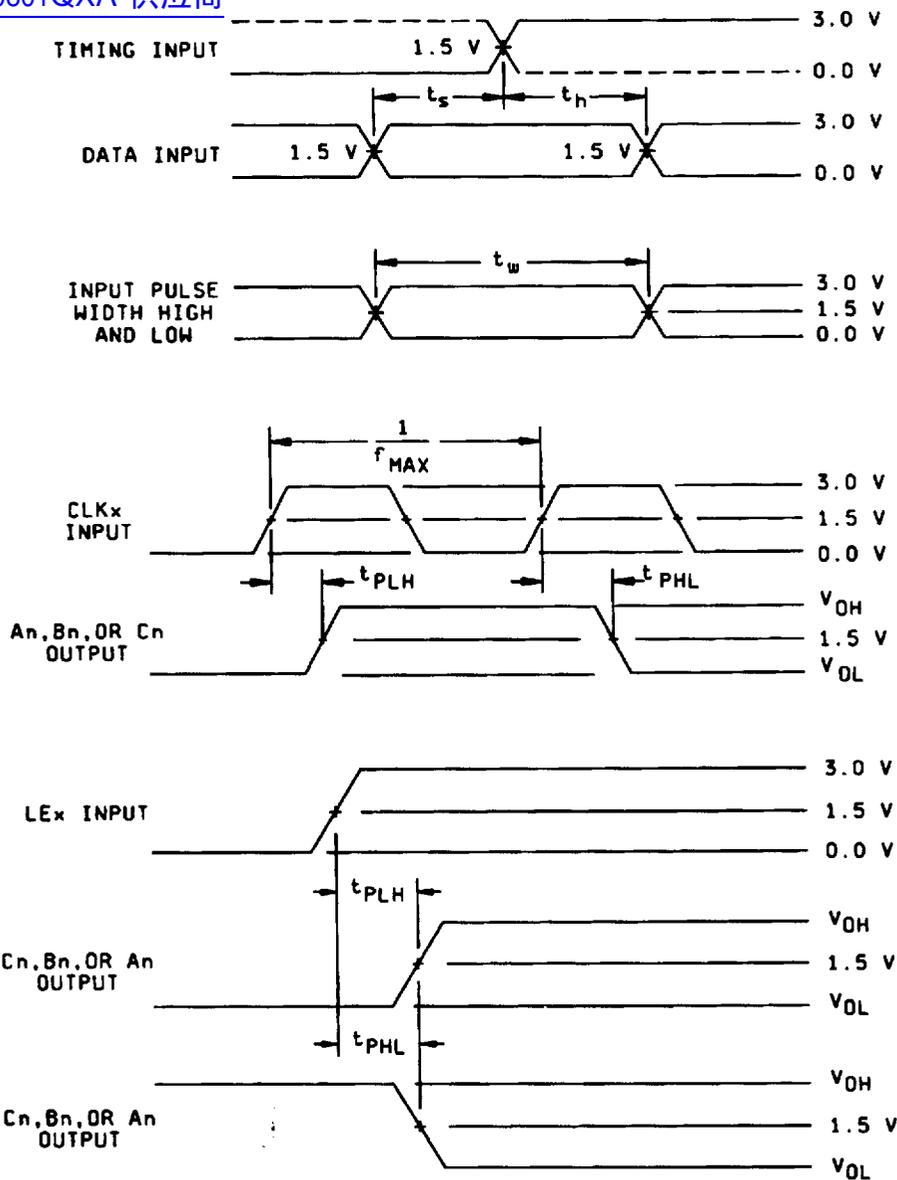
FIGURE 6. Switching waveforms and test circuit.

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An,Bn,Cn,
OR SELx
INPUT

3.0 V
1.5 V
0.0 V

t_{PLH} t_{PHL}

An,Bn,OR Cn
OUTPUT

V_{OH}
0.5 V
V_{OL}

$\overline{OE}x$
INPUT

3.0 V
1.5 V
0.0 V

t_{PZL} t_{PLZ}

An,Bn,OR Cn
OUTPUT

≈ 3.5 V
1.5 V
V_{OL} +0.3
V_{OL}

t_{PZH} t_{PHZ}

An,Bn,OR Cn
OUTPUT

V_{OH}
V_{OH} -0.3
1.5 V
≈ GND

V_{TEST}

V_{CC}

OTHER INPUTS TIED TO
V_{CC} OR GND AS REQ'D

R_L

PULSE
GENERATOR

V_{IN}

DEVICE
UNDER
TEST

V_{OUT}

R_T

C_L R_L
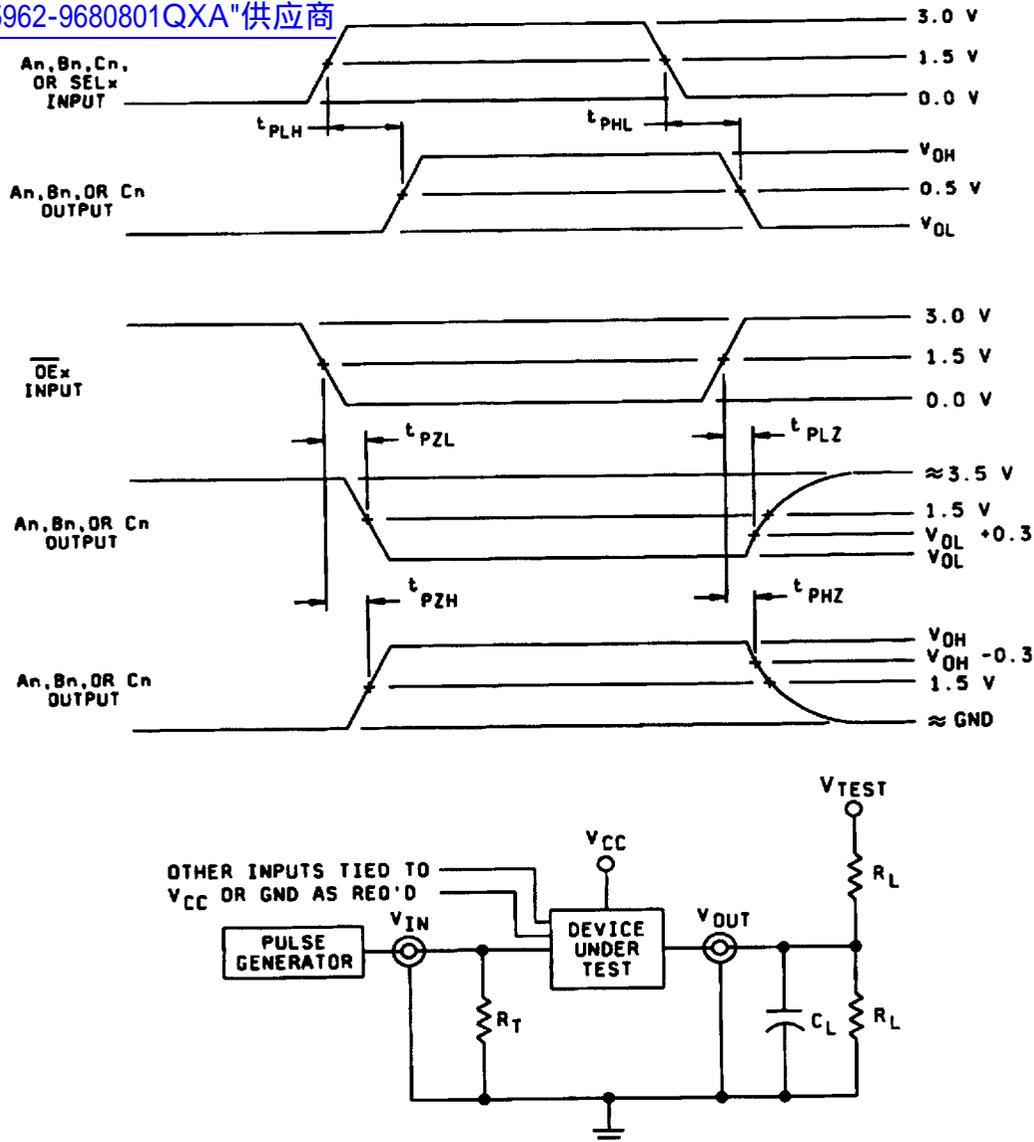
NOTES:

1. When measuring t_{PLZ} and t_{PZL}: V_{TEST} = 7.0 V.
2. When measuring t_{PHZ}, t_{PZH}, t_{PLH}, and t_{PHL}: V_{TEST} = open.
3. The t_{PZL} and t_{PLZ} reference waveform is for the output under test with internal conditions such that the output is at V_{OL} except when disabled by the output enable control. The t_{PZH} and t_{PHZ} reference waveform is for the output under test with internal conditions such that the output is at V_{OH} except when disabled by the output enable control.
4. C_L = 50 pF minimum or equivalent (includes test jig and probe capacitance).
5. R_L = 500Ω or equivalent.
6. R_T = 50Ω or equivalent.
7. Input signal from pulse generator: V_{IN} = 0.0 V to 3.0 V; PRR ≤ 10 MHz; t_r ≤ 2.5 ns; t_f ≤ 2.5 ns; t_r and t_f shall be measured from 0.3 V to 2.7 V and from 2.7 V to 0.3 V, respectively; duty cycle = 50 percent.
8. Timing parameters shall be tested at a minimum input frequency of 1 MHz.
9. The outputs are measured one at a time with one transition per measurement.

FIGURE 6. <u>Switching waveforms and test circuit</u> - Continued.

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3.7 <u>Certificate of conformance</u>. A certificate of conformance as required for device classes Q and V in MIL-PRF-38535 or for device class M in MIL-PRF-38535, appendix A shall be provided with each lot of microcircuits delivered to this drawing. 5962-96808 01QXA"

3.8 <u>Notification of change for device class M</u>. For device class M, notification to DESC-EC of change of product (see 6.2 herein) involving devices acquired to this drawing is required for any change as defined in MIL-STD-973.

3.9 <u>Verification and review for device class M</u>. For device class M, 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.

3.10 <u>Microcircuit group assignment for device class M</u>. Device class M devices covered by this drawing shall be in microcircuit group number 126 (see MIL-PRF-38535, appendix A).

4. QUALITY ASSURANCE PROVISIONS

4.1 <u>Sampling and inspection</u>. For device classes Q and V, sampling and inspection procedures shall be in accordance with MIL-PRF-38535 or as modified in the device manufacturer's Quality Management (QM) plan. The modification in the QM plan shall not affect the form, fit, or function as described herein. For device class M, sampling and inspection procedures shall be in accordance with MIL-PRF-38535, appendix A.

4.2 <u>Screening</u>. For device classes Q and V, screening shall be in accordance with MIL-PRF-38535, and shall be conducted on all devices prior to qualification and technology conformance inspection. For device class M, screening shall be in accordance with method 5004 of MIL-STD-883, and shall be conducted on all devices prior to quality conformance inspection.

4.2.1 <u>Additional criteria for device class M</u>.

   a. Burn-in test, method 1015 of MIL-STD-883.

     (1) Test condition A, B, C, or D. The test circuit shall be maintained by the manufacturer under document revision level control and shall be made available to the preparing or acquiring activity upon request. The test circuit shall specify the inputs, outputs, biases, and power dissipation, as applicable, in accordance with the intent specified in test method 1015 of MIL-STD-883.

     (2) T_A = +125°C, minimum.

   b. Interim and final electrical test parameters shall be as specified in table II herein.

4.2.2 <u>Additional criteria for device classes Q and V</u>.

   a. The burn-in test duration, test condition and test temperature, or approved alternatives shall be as specified in the device manufacturer's QM plan in accordance with MIL-PRF-38535. The burn-in test circuit shall be maintained under document revision level control of the device manufacturer's Technology Review Board (TRB) in accordance with MIL-PRF-38535 and shall be made available to the acquiring or preparing activity upon request. The test circuit shall specify the inputs, outputs, biases, and power dissipation, as applicable, in accordance with the intent specified in test method 1015 of MIL-STD-883.

   b. Interim and final electrical test parameters shall be as specified in table II herein.

   c. Additional screening for device class V beyond the requirements of device class Q shall be as specified in MIL-PRF-38535, appendix B.

4.3 <u>Qualification inspection for device classes Q and V</u>. Qualification inspection for device classes Q and V shall be in accordance with MIL-PRF-38535. Inspections to be performed shall be those specified in MIL-PRF-38535 and herein for groups A, B, C, D, and E inspections (see 4.4.1 through 4.4.4).

4.3.1 <u>Electrostatic discharge sensitivity qualification inspection</u>. Electrostatic discharge sensitivity (ESDS) testing shall be performed in accordance with MIL-STD-883, method 3015. ESDS testing shall be measured only for initial qualification and after process or design changes which may affect ESDS classification.

4.4 <u>Conformance inspection</u>. Technology conformance inspection for classes Q and V shall be in accordance with MIL-PRF-38535 including groups A, B, C, D, and E inspections and as specified herein except where option 2 of MIL-PRF-38535 permits alternate in-line control testing. Quality conformance inspection for device class M shall be in accordance with MIL-PRF-38535, appendix A and as specified herein. Inspections to be performed for device class M shall be those specified in method 5005 of MIL-STD-883 and herein for groups A, B, C, D, and E inspections (see 4.4.1 through 4.4.4).

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TABLE II. Electrical test requirements.

"5962-96808 01QXA" Test requirements	Subgroups (in accordance with MIL-STD-883, method 5005, table I)	Subgroups (in accordance with MIL-PRF-38535, table III)	
	Device class M	Device class Q	Device class V
Interim electrical parameters (see 4.2)	- - -	- - -	1
Final electrical parameters (see 4.2)	1/ 1, 2, 3, 7, 8, 9, 10, 11	1/ 1, 2, 3, 7, 8, 9, 10, 11	2/ 1, 2, 3, 7, 8, 9, 10, 11
Group A test requirements (see 4.4)	1, 2, 3, 4, 7, 8, 9, 10, 11	1, 2, 3, 4, 7, 8, 9, 10, 11	1, 2, 3, 4, 7, 8, 9, 10, 11
Group C end-point electrical parameters (see 4.4)	1, 2, 3	1, 2, 3	1, 2, 3, 7, 8, 9, 10, 11
Group D end-point electrical parameters (see 4.4)	1, 2, 3	1, 2, 3	1, 2, 3
Group E end-point electrical parameters (see 4.4)	1, 7, 9	1, 7, 9	1, 7, 9

1/ PDA applies to subgroup 1.
2/ PDA applies to subgroups 1 and 7.

4.4.1 Group A inspection.

a. Tests shall be as specified in table II herein.

b. For device class M, subgroups 7 and 8 tests shall be sufficient to verify the truth tables in figure 3 herein. The test vectors used to verify the truth tables shall, at a minimum, test all functions of each input and output. All possible input to output logic patterns per function shall be guaranteed, if not tested, to the truth tables in figure 3, herein. For device classes Q and V, subgroups 7 and 8 shall include verifying the functionality of the device; these tests shall have been fault graded in accordance with MIL-STD-883, test method 5012 (see 1.5 herein).

c. C_{IN} and $C_{I/O}$ shall be measured only for initial qualification and after process or design changes which may affect capacitance. C_{IN} and $C_{I/O}$ shall be measured between the designated terminal and GND at a frequency of 1 MHz. This test may be performed at 10 MHz and guaranteed, if not tested, at 1 MHz. The DC bias for the pin under test (V_{BIAS}) = 2.5 V or 3.0 V. For C_{IN} and $C_{I/O}$, test all applicable pins on five devices with zero failures.

For C_{IN} and $C_{I/O}$, a device manufacturer may qualify devices by functional groups. A specific functional group shall be composed of function types, that by design, will yield the same capacitance values when tested in accordance with table I, herein. The device manufacturer shall set a function group limit for the C_{IN} and $C_{I/O}$ tests. The device manufacturer may then test one device functional group, to the limits and conditions specified herein. All other device functions in that particular functional group shall be guaranteed, if not tested, to the limits and test conditions specified in table I, herein. The device manufacturers shall submit to DESC-EC the device functions listed in each functional group and the test results for each device tested.

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d. Ground and V_{CC} bounce tests are required for all device classes. These tests shall be performed only for initial qualification, after process or design changes which may affect the performance of the device, and any changes to the test fixture. V_{OLP}, V_{OLV}, V_{OHP}, and V_{OHV} shall be measured for the worst case outputs of the device. All other outputs shall be guaranteed, if not tested, to the limits established for the worst case outputs. The worst case outputs tested are to be determined by the manufacturer. Test 5 devices assembled in the worst case package type supplied to this document. All other package types shall be guaranteed, if not tested, to the limits established for the worst case package. The 5 devices to be tested shall be the worst case device type supplied to this drawing. All other device types shall be guaranteed, if not tested, to the limits established for the worst case device type. The package type and device type to be tested shall be determined by the manufacturer. The device manufacturer will submit to DESC-EC data that shall include all measured peak values for each device tested and detailed oscilloscope plots for each V_{OLP}, V_{OLV}, V_{OHP}, and V_{OHV} from one sample part per function. The plot shall contain the waveforms of both a switching output and the output under test.

Each device manufacturer shall test product on the fixtures they currently use. When a new fixture is used, the device manufacturer shall inform DESC-EC of this change and test the 5 devices on both the new and old test fixtures. The device manufacturer shall then submit to DESC-EC data from testing on both fixtures, that shall include all measured peak values for each device tested and detailed oscilloscope plots for each V_{OLP}, V_{OLV}, V_{OHP}, and V_{OHV} from one sample part per function. The plot shall contain the waveforms of both a switching output and the output under test.

For V_{OHP}, V_{OHV}, V_{OLP}, and V_{OLV}, a device manufacturer may qualify devices by functional groups. A specific functional group shall be composed of function types, that by design, will yield the same test values when tested in accordance with table I, herein. The device manufacturer shall set a functional group limit for the V_{OHP}, V_{OHV}, V_{OLP}, and V_{OLV} tests. The device manufacturer may then test one device function from a functional group, to the limits and conditions specified herein. All other device functions in that particular functional group shall be guaranteed, if not tested, to the limits and conditions specified in table I, herein. The device manufacturers shall submit to DESC-EC the device functions listed in each functional group and test results, along with the oscilloscope plots, for each device tested.

4.4.2 **Group C inspection.** The group C inspection end-point electrical parameters shall be as specified in table II herein.

4.4.2.1 **Additional criteria for device class M.** Steady-state life test conditions, method 1005 of MIL-STD-883:

a. Test condition A, B, C, or D. The test circuit shall be maintained by the manufacturer under document revision level control and shall be made available to the preparing or acquiring activity upon request. The test circuit shall specify the inputs, outputs, biases, and power dissipation, as applicable, in accordance with the intent specified in test method 1005 of MIL-STD-883.

b. T_A = +125°C, minimum.

c. Test duration: 1,000 hours, except as permitted by method 1005 of MIL-STD-883.

4.4.2.2 **Additional criteria for device classes Q and V.** The steady-state life test duration, test condition and test temperature, or approved alternatives shall be as specified in the device manufacturer's QM plan in accordance with MIL-PRF-38535. The test circuit shall be maintained under document revision level control by the device manufacturer's TRB in accordance with MIL-PRF-38535 and shall be made available to the acquiring or preparing activity upon request. The test circuit shall specify the inputs, outputs, biases, and power dissipation, as applicable, in accordance with the intent specified in test method 1005 of MIL-STD-883.

4.4.3 **Group D inspection.** The group D inspection end-point electrical parameters shall be as specified in table II herein.

4.4.4 **Group E inspection.** Group E inspection is required only for parts intended to be marked as radiation hardness assured (see 3.5 herein).

a. End-point electrical parameters shall be as specified in table II herein.

b. For device classes Q and V, the devices or test vehicle shall be subjected to radiation hardness assured tests as specified in MIL-PRF-38535 for the RHA level being tested. For device class M, the devices shall be subjected to radiation hardness assured tests as specified in MIL-PRF-38535, appendix A for the RHA level being tested. All device classes must meet the postirradiation end-point electrical parameter limits as defined in table I at T_A = +25°C ±5°C, after exposure, to the subgroups specified in table II herein.

c. When specified in the purchase order or contract, a copy of the RHA delta limits shall be supplied.

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

4.5.1 **Voltage and current.** Unless otherwise specified, all voltages given are referenced to the microcircuit GND terminal. Currents given are conventional current and positive when flowing into the referenced terminal.

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5. PACKAGING

5.1   Packaging requirements. The requirements for packaging shall be in accordance with MIL-PRF-38535 for device classes Q and V or MIL-PRF-38535, appendix A for device class M.

6. NOTES

6.1   Intended use. Microcircuits conforming to this drawing are intended for use for Government microcircuit applications (original equipment), design applications, and logistics purposes.

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

6.1.2   Substitutability. Device class Q devices will replace device class M devices.

6.2   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-973 using DD Form 1692, Engineering Change Proposal.

6.3   Record of users. Military and industrial users should 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 drawings covering microelectronic devices (FSC 5962) should contact DESC-EC, telephone (513) 296-6047.

6.4   Comments. Comments on this drawing should be directed to DESC-EC, Dayton, Ohio 45444-5270, or telephone (513) 296-5377.

6.5   Abbreviations, symbols, and definitions. The abbreviations, symbols, and definitions used herein are defined in MIL-PRF-38535 and MIL-HDBK-1331.

6.6   Sources of supply.

6.6.1   Sources of supply for device classes Q and V. Sources of supply for device classes Q and V are listed in QML-38535. The vendors listed in QML-38535 have submitted a certificate of compliance (see 3.6 herein) to DESC-EC and have agreed to this drawing.

6.6.2   Approved sources of supply for device class M. Approved sources of supply for class M are listed in MIL-HDBK-103. The vendors listed in MIL-HDBK-103 have agreed to this drawing and a certificate of compliance (see 3.6 herein) has been submitted to and accepted by DESC-EC.

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