REVISIONS

LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED

REV																										
SHEET																										
REV																										
SHEET																										

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

PMIC N/A

STANDARDIZED MILITARY DRAWING

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

AMSC N/A

PREPARED BY Joseph A. Kirby

CHECKED BY Charles E. Besore

APPROVED BY

DRAWING APPROVAL DATE 91-02-07

REVISION LEVEL

DEFENSE ELECTRONICS SUPPLY CENTER
DAYTON, OHIO 45444

MICROCIRCUITS, LINEAR, 4-CHANNEL,
MULTIPLEXER AMPLIFIER,
MONOLITHIC SILICON

SIZE	CAGE CODE	
A	67268	**5962-89639**

SHEET 1

DESC FORM 193
SEP 87

U.S. GOVERNMENT PRINTING OFFICE: 1987 — 748-129/60911

5962-E028

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:

5962-89639	01	V	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	LM604	4-channel multiplexer amplifier

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
V	D-6 (18-lead, .960" x .310" x .200"), dual-in-line package

1.3 Absolute maximum ratings.

Supply voltage (V_S)	36 V dc or ±18 V dc
Differential input voltage	±18 V dc
Input voltage range	±18 V dc
Output short circuit to GND 1/	Continuous
Storage temperature range	-65°C to +150°C
Lead temperature (soldering, 5 seconds)	+300°C
Junction temperature (T_J)	+150°C
Power dissipation (P_D) 2/ 3/	1.6 W
Thermal resistance:	
Junction-to-case (θ_{JC})	See MIL-M-38510, appendix C
Junction-to-ambient (θ_{JA})	75°C/W

1.4 Recommended operating conditions.

Supply voltage (V_S)	±15 V dc
Ambient operating temperature range (T_A)	-55°C to +125°C

1/ Applied to both single and split supply operation. Continuous short circuit operation can result in exceeding the maximum allowed junction temperature.

2/ When operating at $T_A > 25°C$, the maximum power dissipation must be derated based on θ_{JA}.

3/ Must withstand the added P_D due to short circuit test; e.g., I_{OS}.

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 Block diagram and truth table. The block diagram and truth table shall be as specified on figure 2.

3.2.4 Channel switching waveforms. The channel switching waveforms shall be as specified on figure 3.

3.2.5 Output disable and enable waveforms. The output disable and enable waveforms shall be as specified on figure 4.

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 ambient 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.

* U. S. GOVERNMENT PRINTING OFFICE 1990-549-249

TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions $-55^\circ C \le T_A \le +125^\circ C$ $V_S = \pm 15$ V $V_{OUT} = 0$ V, $V_{CM} = 0$ V unless otherwise specified	Group A subgroups	Limits		Unit
				Min	Max	
Input offset voltage	V_{IO}	$R_S = 10$ kΩ	1	-1	+1	mV
			2, 3	-3	+3	
		$V+ = 5$ V, $V_{OUT} = 2$ V, $R_S = 10$ kΩ, $V- = 0$ V	1	-1	+1	
			2, 3	-3	+3	
Input offset current	I_{IO}		1	-10	+10	nA
			2, 3	-12	+12	
		$V+ = 5$ V, $V_{OUT} = 2$ V, $V- = 0$ V	1	-10	+10	
			2, 3	-18	+18	
Input bias current	I_{IB}		1	-50	+50	nA
			2, 3	-60	+60	
		$V+ = 5$ V, $V_{OUT} = 2$ V, $V- = 0$ V	1	-80	+80	
			2, 3	-110	+110	
Input common mode voltage range	$+V_{CM}$		1	13.5		V
			2, 3	13.0		
	$-V_{CM}$		1, 2, 3		-15	
Positive output voltage swing high	$+V_{OP}$	$R_L = 10$ kΩ	1	13		V
			2, 3	12.5		
		$R_L = 10$ kΩ, $V+ = 5$ V, $V- = 0$ V	1	3.2		
			2, 3	3.0		
		$R_L = 600Ω$	1	12.3		
			2, 3	10		

See footnotes at end of table.

STANDARDIZED MILITARY DRAWING **DEFENSE ELECTRONICS SUPPLY CENTER** **DAYTON, OHIO 45444**	**SIZE** **A**		5962-89639
		REVISION LEVEL	**SHEET** 4

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions $-55^\circ C \leq T_A \leq +125^\circ C$ $V_S = \pm 15$ V $V_{OUT} = 0$ V, $V_{CM} = 0$ V unless otherwise specified	Group A subgroups	Limits		Unit
				Min	Max	
Positive output voltage swing high	$+V_{OP}$	$R_L = 600\Omega$, $V+ = 5$ V, $V- = 0$ V	1	3.0		V
			2, 3	2.8		
Output voltage swing low	$-V_{OP}$	$R_L = 10$ kΩ	1		-13.8	V
			2, 3		-13.3	
		$R_L = 10$ kΩ, $V+ = 5$ V, $V- = 0$ V	1		0.7	
			2, 3		0.8	
		$R_L = 600\Omega$	1		-12.2	
			2, 3		-11.7	
		$R_L = 600\Omega$, $V+ = 5$ V, $V- = 0$ V	1		0.6	
			2, 3		0.7	
Large signal voltage gain	A_V	$V_{OUT} = 0$ to 10 V, $R_L = 2$ kΩ	4	50		V/mV
		$V_{OUT} = 0$ to -10 V, $R_L = 2$ kΩ				
		$V_{OUT} = 0$ to 10 V, $R_L = 600\Omega$				
		$V_{OUT} = 0$ to -10 V, $R_L = 600\Omega$				
		$V_{OUT} = 0$ to 10 V, $R_L = 2$ kΩ	5, 6	25		
		$V_{OUT} = 0$ to -10 V, $R_L = 2$ kΩ				
		$V_{OUT} = 0$ to 10 V, $R_L = 600\Omega$				
		$V_{OUT} = 0$ to -10 V, $R_L = 600\Omega$				
Common mode rejection ratio	CMRR	$V_{CM} = -15$ V to 13.5 V	4	80		dB
			5, 6	70		

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions $-55^\circ\text{C} \le T_A \le +125^\circ\text{C}$ $V_S = \pm15$ V $V_{OUT} = 0$ V, $V_{CM} = 0$ V unless otherwise specified	Group A subgroups	Limits Min	Limits Max	Unit
Common mode rejection ratio	CMRR	$V+ = 5$ V, $V_{CM} = 0$ V to 3.5 V, $V_{OUT} = 2$ V, $V- = 0$ V	4	80		dB
			5, 6	70		
Power supply rejection ratio	PSRR	$V_S = \pm5.0$ V to ±16.0 V	4	80		dB
			5, 6	70		
		$V+ = 4.0$ V to 5.0 V, $V- = 0$ V	4	80		
			5, 6	70		
Output short circuit current	I_{OS}		1	-50	+50	mA
			2, 3	-60	+60	
Output leakage current	I_O	Bi-state output disabled, $V_{OUT} = 13$ V, $V_{OUT} = 0$ V, $V_{OUT} = -13.5$ V	1	-10	+10	µA
			2, 3	-20	+20	
Supply current	I_S		1		9	mA
			2, 3		10	
Digital input threshold voltage 1/ 2/	V_{IH}, V_{IL}		1	1.0	1.8	V
			2, 3	0.8	2.0	
Digital input current high 1/ 2/	I_{IH}		1		±5	µA
			2, 3		±10	
Digital input current low 1/ 2/	I_{IL}		1		±5	
			2, 3		±10	
Negative slew rate	-SR	$R_L = 2$ kΩ, $A_V = 1$	4	2.0		V/µs
			5, 6	1.5		
Positive slew rate	+SR	$R_L = 2$ kΩ, $A_V = 1$	4	2.0		
			5, 6	1.5		

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions $-55^{\circ}C \leq T_A \leq +125^{\circ}C$ $V_S = \pm 15$ V $V_{OUT} = 0$ V, $V_{CM} = 0$ V unless otherwise specified	Group A subgroups	Limits		Unit
				Min	Max	
Gain bandwidth product	GBW	f = 100 kHz	4	6		MHz
			5, 6	3		
Channel switching time	t_{SW1}	Channel 2 to channel 1 Channel 1 to channel 2 Channel 4 to channel 3 Channel 3 to channel 4 See figure 3	9		5.5	µs
			10, 11		6.5	
Multiplexer amplifier enable time	t_{EN1}	See figure 4	9		4.0	
			10, 11		5.0	
Multiplexer amplifier disable time	t_{DIS}	See figure 4	9		2.0	
			10, 11		3.0	

1/ Digital input tests are for A, B, $\overline{EN}$, $\overline{WR}$, and $\overline{CS}$ pins.

2/ Input voltage levels are with respect to digital ground (pin 4) which must be at least 4.0 V below V+.

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.

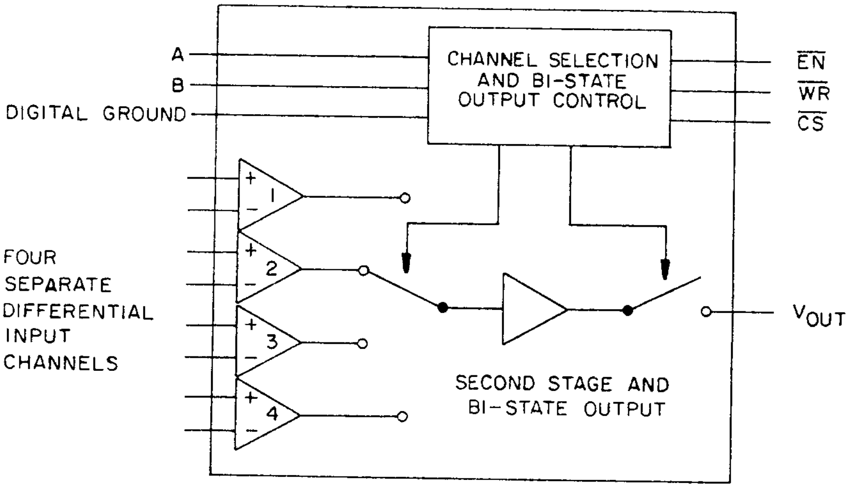
3.7 Certificate of conformance. A certificate of conformance as required in MIL-STD-883 (see 3.1 herein) shall be provided with each lot of microcircuits delivered to this drawing.

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.

Device type	01
Case outline	V
Terminal number	Terminal symbol
1	A
2	B
3	OPEN PIN
4	DIGITAL GROUND
5	V+
6	Channel 1-
7	Channel 1+
8	Channel 2-
9	Channel 2+
10	Channel 3+
11	Channel 3-
12	Channel 4+
13	Channel 4-
14	V_{OUT}
15	V-
16	$\overline{CS}$
17	$\overline{WR}$
18	$\overline{EN}$

FIGURE 1. Terminal connections.



Channel selection

A	B	$\overline{WR}$	$\overline{CS}$	Channel
0	0	0	0	1
0	1	0	0	2
1	0	0	0	3
1	1	0	0	4
X	X	X	1	Unchanged
X	X	1	X	Unchanged

Bi-state output control

$\overline{EN}$	$\overline{WR}$	$\overline{CS}$	Output state
0	0	0	Enabled
1	0	0	Disabled, High Z
X	X	1	Unchanged
X	1	X	Unchanged

FIGURE 2. Block diagram and truth table.

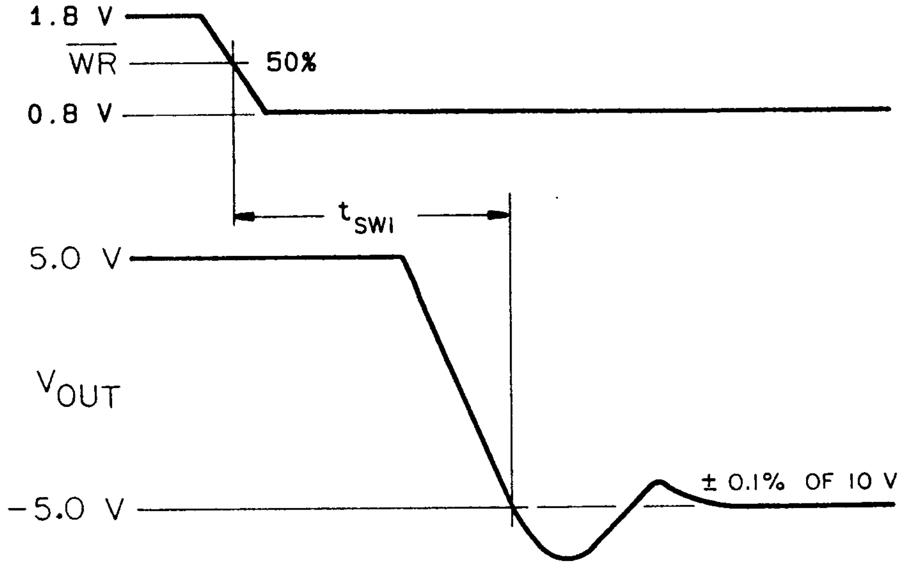


FIGURE 3. Channel switching waveforms.

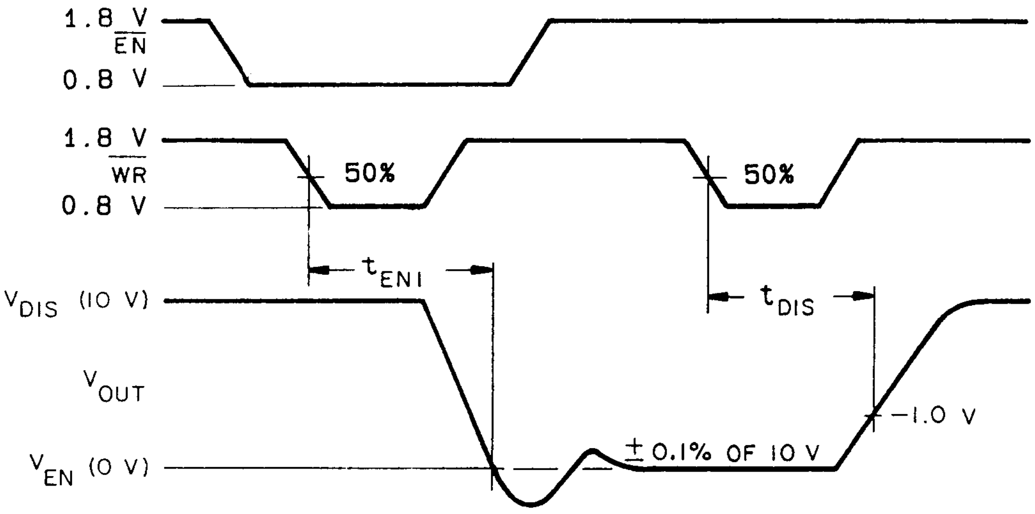


FIGURE 4. Output disable and output enable waveforms.

STANDARDIZED MILITARY DRAWING **DEFENSE ELECTRONICS SUPPLY CENTER DAYTON, OHIO 45444**	**SIZE** **A**		5962-89639
		REVISION LEVEL	**SHEET** 11

☆ U. S. GOVERNMENT PRINTING OFFICE: 1988—549-904

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°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.

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 7 and 8 in table I of method 5005 of MIL-STD-883 shall be omitted.

TABLE II. Electrical test requirements.

MIL-STD-883 test requirements	Subgroups (per method 5005, table I)
Interim electrical parameters (method 5004)	1
Final electrical test parameters (method 5004)	1*,2,3,4,5,6, 9,10,11
Group A test requirements (method 5005)	1,2,3,4,5,6,9, 10,11
Groups C and D end-point electrical parameters (method 5005)	1,2,3

* PDA applies to subgroup 1.

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°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-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 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-ECS.