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												

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

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DRAWING APPROVAL DATE
28 DECEMBER 1989

REVISION LEVEL

DEFENSE ELECTRONICS SUPPLY CENTER
DAYTON, OHIO 45444

MICROCIRCUIT, LINEAR, DUAL, CMOS, 12-BIT, D/A CONVERTER, MONOLITHIC SILICON

SIZE	CAGE CODE	
A	67268	5962-89657

SHEET 1

DESC FORM 193
SEP 87

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

5962-E1389

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 number. The complete part number shall be as shown in the following example:

5962-89657	01	L	X
Drawing number	Device type (1.2.1)	Case outline (1.2.2)	Lead finish per MIL-M-38510

1.2.1 Device types. The device types shall identify the circuit function as follows:

Device type	Generic number	Circuit function	Gain error
01	7547S	Dual, CMOS, 12-bit DAC	±6.0 LSB
02	7547T	Dual, CMOS, 12-bit DAC	±3.0 LSB
03	7547U	Dual, CMOS, 12-bit DAC	±2.0 LSB

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

Outline letter	Case outline
L	D-9 (24-lead, 1.280" x .310" x .200"), dual-in-line package

1.3 Absolute maximum ratings.

V_{DD} to DGND	0.3 V dc to +17 V dc
V_{REFA}, V_{REFB} to AGND	±25 V dc
V_{RFBA}, V_{RFBB} to AGND	±25 V dc
Digital input voltage to DGND	0.3 V dc to V_{DD} +0.3 V
Voltage at I_{OUTA}, I_{OUTB} to DGND	-0.3 V dc to V_{DD} +0.3 V
AGND to DGND	-0.3 V dc to V_{DD} +0.3 V
Storage temperature range	-65°C to +150°C
Lead temperature (soldering, 10 seconds)	+300°C
Power dissipation (P_D)	450 mW 1/
Thermal resistance, junction-to-case (θ_{JC})	See MIL-M-38510, appendix C
Thermal resistance, junction-to-ambient (θ_{JA})	120°C/W
Junction temperature (T_J)	+175°C

1.4 Recommended operating conditions.

Supply voltage range (V_{DD})	10.8 V dc to 16.5 V dc
Minimum high level input voltage	2.4 V dc
Maximum low level input voltage	0.8 V dc
Ambient operating temperature range (T_A)	-55°C to +125°C
Voltage at V_{REFA}, V_{REFB}	10 V dc
Voltage at AGND, I_{OUTA}	0 V dc
Voltage at AGND, I_{OUTB}	0 V dc

1/ Derate above T_A = +75°C at 6.0 mW/°C.

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

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

3.2.3 Case outline. The case outline shall be in accordance with 1.2.2 herein.

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.

3.5 Marking. Marking shall be in accordance with MIL-STD-883 (see 3.1 herein). The part shall be marked with the part number listed in 1.2 herein. In addition, the manufacturer's part number may also be marked as listed in MIL-BUL-103 (see 6.6 herein).

TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions 1/ $-55°C < T_A < +125°C$ unless otherwise specified	Device type	Group A subgroups	Limits Min	Limits Max	Unit
Resolution 2/	RES	Guaranteed minimum resolution	All	1,2,3	12		Bits
Relative accuracy	RA	V_{DD} = 10.8 V and 16.5 V	01	1,2,3		±1.0	LSB
			02, 03	1		±1.0	
				2,3,12		±0.5	
Differential nonlinearity	DNL	Guaranteed monotonic to 12-bits, V_{DD} = 10.8 V and 16.5 V	All	1,2,3		±1.0	LSB
Gain error	A_E	Measured using RFBA and RFBB. Both DAC registers loaded with all 1's, V_{DD} = 10.8 V	01	1,2,3		±6.0	LSB
			02	1		±3.0	
			03			±2.0	
			02	2,3,12		±3.0	
			03			±2.0	
Gain temperature coefficient 2/	$\frac{\Delta A_E}{\Delta T}$		All	4		±5.0	ppm/°C
Power supply rejection ratio, V_{REFB} to I_{OUTB}	PSRR	V_{DD} = 10.8 V and 16.5 V	All	1		±0.01	%/%
		V_{DD} = 10.8 V		2,3		±0.02	
Output leakage current	I_{OUTA}	DAC A loaded with all 0's, V_{DD} = 16.5 V	All	1		±10	nA
				2,3		±250	
	I_{OUTB}	DAC B loaded with all 0's, V_{DD} = 16.5 V	All	1		±10	nA
				2,3		±250	

See footnotes at end of page.

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions 1/ $-55°C < T_A < +125°C$ unless otherwise specified	Device type	Group A subgroups	Limits Min	Limits Max	Unit
Output current settling time to 0.01% of FSR 2/	t_{SL}	I_{OUT} load = 100Ω, C_{EXT} = 13 pF, DAC output measured from falling edge of WR	All	9		1.5	µs
				10,11		1.5	
Feedthrough error, V_{REFA} to I_{OUTA} or V_{REFB} to I_{OUTB} 2/	FT	$V_{REFA} = V_{REFB}$ = ±20 Vpp, 10 kHz sine wave, DAC register loaded with all 0's	All	4		-65	dB
				5,6		-65	
Reference input resistance	R_{IN}	V_{DD} = 10.8 V	All	1,2,3	9.0	20	kΩ
Reference input resistance match (V_{REFA}/V_{REFB})	R_{MIN}	V_{DD} = 10.8 V	01,02	1,2,3		±3.0	%
			03	1		±3.0	
				2,3		±1.0	
Digital input high voltage	V_{IH}	V_{DD} = 10.8 V and 16.5 V	All	1,2,3	2.4		V
Digital input low voltage	V_{IL}	V_{DD} = 10.8 V and 16.5 V	All	1,2,3		0.8	V
Input current	I_{IN}	$V_{IN} = V_{DD}$ = 16.5 V	All	1		1.0	µA
				2,3		10	
Digital input capacitance 2/	C_{IN}	T_A = +25°C	All	4		10	pF
Output capacitance 2/	C_{OUTA}	DAC A = all 0's, T_A = +25°C	All	4		70	pF
		DAC A = all 1's, T_A = +25°C				140	
Output capacitance 2/	C_{OUTB}	DAC B = all 0's, T_A = +25°C	All	4		70	pF
		DAC B = all 1's, T_A = +25°C				140	

See footnotes at end of table.

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TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions 1/ $-55°C < T_A < +125°C$ unless otherwise specified	Device type	Group A subgroups	Limits		Unit
					Min	Max	
Functional test		See figure 4.3.1c	All	7			
Data setup time	t_{DS}	See figure 3	All	9	60		ns
				10,11 2/	80		
Data hold time	t_{DH}	See figure 3	All	9	25		ns
				10,11 2/	25		
Chip select or update to write setup time	t_{CWS}	See figure 3	All	9	80		ns
				10,11 2/	100		
Chip select or update to write hold time	t_{CWH}	See figure 3	All	9	0		ns
				10,11 2/	0		
Write pulse width	t_{WR}	See figure 3	All	9	80		ns
				10,11 2/	100		
Supply current	I_{DD}	V_{DD} = 16.5 V	All	1,2,3		2.0	mA

1/ V_{DD} = 10.8 V to 16.5 V, unless otherwise specified. $V_{REFA} = V_{REFB}$ = 10 V, voltage at AGND = 0 V, voltage at $I_{OUTA} = I_{OUTB}$ = 0 V.

2/ If not tested, shall be guaranteed to the limits specified in table I.

Device type(s)	01, 02, 03
Case outline(s)	L
Terminal number	Terminal symbol
1	AGND
2	I_{OUTA}
3	R_{FBA}
4	V_{REFA}
5	$\overline{CSA}$
6	DB_0(LSB)
7	DB_1
8	DB_2
9	DB_3
10	DB_4
11	DB_5
12	DGND
13	DB_6
14	DB_7
15	DB_8
16	DB_9
17	DB_{10}
18	DB_{11}(MSB)
19	$\overline{WR}$
20	$\overline{CSB}$
21	V_{DD}
22	V_{REFB}
23	R_{FBB}
24	I_{OUTB}

FIGURE 1. Terminal connections.

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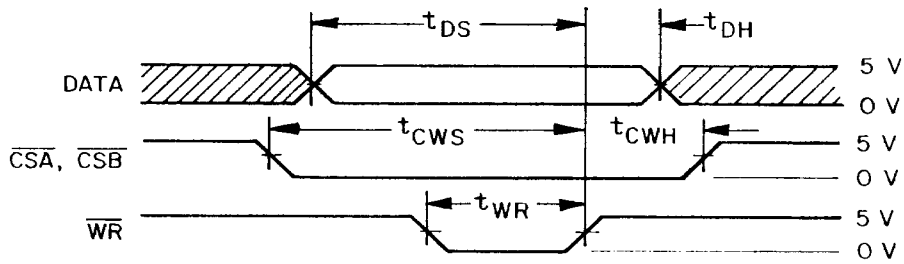
$\overline{CSA}$	$\overline{CSB}$	$\overline{WR}$	Function
X	X	1	No data transfer
1	1	X	No data transfer
⌐	⌐	0	A rising edge on $\overline{CSA}$ or $\overline{CSB}$ loads data to the respective DAC from data bus
0	1	⌐	DACA register loaded from data bus
1	0	⌐	DACB register loaded from data bus
0	0	⌐	DACA and DACB register loaded from data bus

0 = Logic low level
1 = Logic high level
X = Irrelevant
⌐ = Rising edge triggered

FIGURE 2. Truth table.



NOTES:
1. All input signal rise and fall times are measured from 10% to 90% of +5.0 V, $t_r = t_f = 20$ ns.
2. Timing measurement reference level is $\frac{V_{IH} + V_{IL}}{2}$

FIGURE 3. Timing diagram.

3.6 Certificate of compliance. A certificate of compliance shall be required from a manufacturer in order to be listed as an approved source of supply in MIL-BUL-103 (see 6.6 herein). The certificate of compliance submitted to DESC-ECS prior to listing as an approved source of supply shall affirm that the manufacturer's product meets the requirements of MIL-STD-883 (see 3.1 herein) and the requirements herein.

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

3.8 Notification of change. Notification of change to DESC-ECS shall be required in accordance with MIL-STD-883 (see 3.1 herein).

3.9 Verification and review. DESC, DESC's agent, and the acquiring activity retain the option to review the manufacturer's facility and applicable required documentation. Offshore documentation shall be made available onshore at the option of the reviewer.

4. QUALITY ASSURANCE PROVISIONS

4.1 Sampling and inspection. Sampling and inspection procedures shall be in accordance with section 4 of MIL-M-38510 to the extent specified in MIL-STD-883 (see 3.1 herein).

4.2 Screening. Screening shall be in accordance with method 5004 of MIL-STD-883, and shall be conducted on all devices prior to quality conformance inspection. The following additional criteria shall apply:

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

(1) Test condition A, B, C, or D using the circuit submitted with the certificate of compliance (see 3.6 herein).

(2) T_A = +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.

c. Subgroup 12 test is used for grading and part selection at +25°C and is not included in PDA calculations.

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

c. Subgroup 7 shall verify the truth table as specified on figure 2 herein.

d. Subgroup 12 test is used for grading and part selection at T_A = +25°C.

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*,2,3,7,12
Group A test requirements (method 5005)	1,2,3,4**,5**,6**, 7,9,10**,11**,12
Groups C and D end-point electrical parameters (method 5005)	1

* PDA applies to subgroup 1.
** If not tested, shall be guaranteed to the limits specified in table I.

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 Electronic 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 source of supply. An approved source of supply is listed in MIL-BUL-103. Additional sources will be added to MIL-BUL-103 as they become available. The vendor listed in MIL-BUL-103 has agreed to this drawing and a certificate of compliance (see 3.6 herein) has been submitted to and accepted by DESC-ECS. The approved source of supply listed below is for information purposes only and is current only to the date of the last action of this document.

Military drawing part number	Vendor CAGE number	Vendor similar part number 1/
5962-8965701LX	24355	AD7547SQ/883B
5962-8965702LX	24355	AD7547TQ/883B
5962-8965703LX	24355	AD7547UQ/883B

1/ Caution. Do not use this number for item acquisition. Items acquired by this number may not satisfy the performance requirements of this drawing.

Vendor CAGE number	Vendor name and address
24355	Analog Devices Route 1 Industrial Park P.O. Box 9106 Norwood, MA 02062 Point of contact: 804 Woburn Street Wilmington, MA 01887

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