REVISIONS			
LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED

REV																			
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REV STATUS OF SHEETS	REV														
	SHEET	1	2	3	4	5	6	7	8	9	10	11	12	13	14

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DRAWING APPROVAL DATE
92-02-10

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DEFENSE ELECTRONICS SUPPLY CENTER
DAYTON, OHIO 45444

STANDARDIZED MILITARY DRAWING

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

AMSC N/A

MICROCIRCUIT, LINEAR, 16-BIT, DIGITAL TO SYNCHRO AND DIGITAL TO RESOLVER CONVERTER, HYBRID

SIZE	CAGE CODE	5962-89986
A	67268	

SHEET 1 OF 15

DESC FORM 193
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DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

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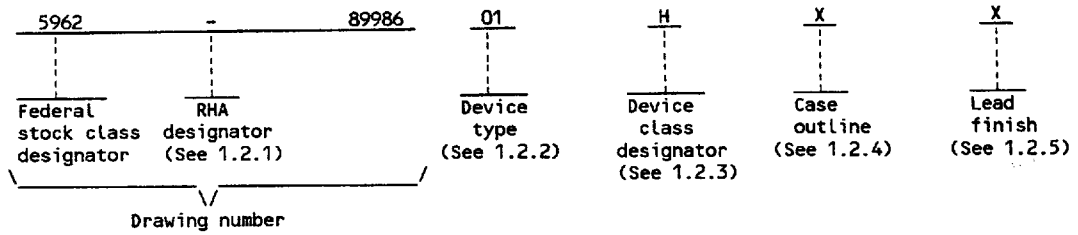
1. SCOPE

1.1 Scope. This drawing forms a part of a one part - one part number documentation system (see 6.6 herein). This drawing describes device requirements for hybrid microcircuits to be processed in accordance with MIL-H-38534. Two product assurance classes, military high reliability (device class H) and space application (device class K) and 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 levels are reflected in the PIN.

1.2 PIN. The PIN shall be as shown in the following example:



1.2.1 Radiation hardness assurance (RHA) designator. Device classes H and K RHA marked devices shall meet the MIL-H-38534 specified RHA levels and shall be marked with the appropriate RHA designator. A dash (-) indicates a non-RHA device.

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

Device type	Generic number	Circuit function	Accuracy
01	DSC-11520-112	16-Bit D/S and D/R converter	±8 minutes
02	DSC-11520-113	16-Bit D/S and D/R converter	±4 minutes
03	DSC-11520-114	16-Bit D/S and D/R converter	±2 minutes
04	DSC-11520-115	16-Bit D/S and D/R converter	±1 minute

1.2.3 Device class designator. This device class designator shall be a single letter identifying the product assurance level as follows:

Device class	Device requirements documentation
H or K	Certification and qualification to MIL-H-38534

1.2.4 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
X	See figure 1 (36-lead, 1.900" x .780" x .210"), dual-in-line

1.2.5 Lead finish. The lead finish shall be as specified in MIL-H-38534 for classes H and K. Finish letter "X" shall not be marked on the microcircuit or its packaging. The "X" designation is for use in specifications when lead finishes A, B, and C are considered acceptable and interchangeable without preference.

1.3 Absolute maximum ratings. 1/

Positive supply voltage (V_{CC})	+18 V dc
Negative supply voltage (V_{EE})	-18 V dc
Reference input (RH, RL)	30 V rms
Digital input voltage (BITS 1-16)	-0.3 V dc to + 6.5 V dc
Power dissipation at T_A = +125°C (P_D)	.72 W
Storage temperature range	-65°C to +150°C
Lead temperature (soldering, 10 seconds)	+300°C
Thermal resistance, junction-to-case (θ_{JC})	8.0°C/W
Thermal resistance, junction-to-ambient (θ_{JA})	20°C/W

1.4 Recommended operating conditions.

Positive supply voltage range (V_{CC})	+14.25 V dc to +15.75 V dc
Negative supply voltage range (V_{EE})	-14.25 V dc to -15.75 V dc

2. APPLICABLE DOCUMENTS

2.1 Government specifications, standards, and handbook. Unless otherwise specified, the following specifications, standards, and handbook 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.

SPECIFICATIONS

MILITARY

MIL-M-38510 - Microcircuits, General Specification for.
MIL-H-38534 - Hybrid Microcircuits, General Specification for.

STANDARDS

MILITARY

MIL-STD-480 - Configuration Control-Engineering Changes, Deviations and Waivers.
MIL-STD-883 - Test Methods and Procedures for Microelectronics.

HANDBOOK

MILITARY

MIL-HDBK-780 - Standardized Military Drawings.

(Copies of the specifications, standards, and handbook required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

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.

2.2 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 MIL-H-38534 and as specified herein.

3.2 Design, construction, and physical dimensions. The design, construction, and physical dimensions shall be as specified in MIL-H-38534 and herein.

3.2.1 Case outline(s). The case outline(s) shall be in accordance with 1.2.4 herein and figure 1.

3.2.2 Terminal connections. The terminal connections shall be as specified on figure 2.

3.2.3 Block diagram. The block diagram shall be as specified on figure 3.

3.2.4 Timing diagram. The timing diagram shall be as specified on figure 4.

3.2.5 Pin functions. The pin functions shall be as specified on table III.

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 specified 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-H-38534. 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 QML-38534.

3.6 Manufacturer eligibility. In addition to the general requirements of MIL-H-38534, the manufacturer of the part described herein shall submit for DESC-ECT review and approval electrical test data (variables format) on 22 devices from the initial quality conformance inspection group A lot sample, produced on the certified line, for each device type listed herein. The data should also include a summary of all parameters manually tested, and for those which, if any, are guaranteed.

3.7 Certificate of compliance. A certificate of compliance shall be required from a manufacturer in order to supply to this drawing. The certificate of compliance submitted to DESC-ECT shall affirm that the manufacturer's product meets the requirements of MIL-H-38534 and the requirements herein.

3.8 Certificate of conformance. A certificate of conformance as required in MIL-H-38534 shall be provided with each lot of microcircuits delivered to this drawing.

4. QUALITY ASSURANCE PROVISIONS

4.1 Sampling and inspection. Sampling and inspection procedures shall be in accordance with MIL-H-38534.

4.2 Screening. Screening shall be in accordance with MIL-H-38534. The following additional criteria shall apply:

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

(1) Test condition D using the circuit submitted with the certificate of compliance (see 3.7 herein).

(2) T_A as specified in accordance with table I of method 1015 of MIL-STD-883.

b. Interim and final electrical test parameters shall be as specified in table II herein, except interim electrical parameter tests prior to burn-in are optional at the discretion of the manufacturer.

TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions 1/ $-55°C \le T_C \le +125°C$ unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Resolution, 16-bit	RES	MSB = 180 degrees LSB = .0055 degrees	7,8	All		.33	arc min
Output accuracy	A_{OUT}		7,8	01	-8	+8	min
				02	-4	+4	
				03	-2	+2	
				04	-1	+1	
Differential linearity 2/	DL		7,8	All	-1	+1	LSB
Radius accuracy 2/	RA	3/	7,8	All	-.03	+.03	%
Output settling time	t_s	for any analog or digital step change	9,10,11	All		20	µs
Logic 0 digital input voltage	V_{IL}		1,2,3	All	-.3	1.25	V
Logic 1 digital input voltage	V_{IH}		1,2,3	All	2.0	5.5	V
Digital input load current 2/	I_{IN}	Bits 1 thru 16, V_{IN} = 0 V	1,2,3	All		-20	µA
		$\overline{LL}$, $\overline{LM}$, and $\overline{LA}$, V_{IN} = 5.0 V	1,2,3	All		+20	µA
Standard reference input voltage (RH,RL)	V_{IN}		4,5,6	All	23.4	28.6	V rms
Reference input frequency	f_{IN}		4,5,6	All		1.0	kHz

See footnotes at end of table.

TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions 1/ $-55°C \le T_C \le +125°C$ unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Standard reference 2/ input impedance (RH,RL)	Z_{IN}	single ended	4,5,6	All	99.5	100.5	kΩ
		differential	4,5,6	All	199	201	kΩ
Analog output current	I_{OUT}	short circuit protected	4,5,6	All		2	mA rms
Analog output voltage	V_{OUT}	resolver	4,5,6	All	6.753	6.817	V rms L-L
		synchro	4,5,6	All	11.77	11.83	V rms L-L
Analog output 2/ transformation ratio	AOTR		4,5,6	All	-.2	+.2	%
Analog output impedance 2/	Z_{OUT}	op amp output	4,5,6	All		1	ohm
Analog output offset voltage 2/	V_{OS}	each line to ground	1,2,3	All	-15	+15	mV
Analog output scale factor variation 2/	SFV		7,8	All	-0.05	+0.05	%
Register latch control		$\overline{LL}$, $\overline{LM}$, $\overline{LA}$; data latched	7,8	All			Pass/ Fail
		$\overline{LL}$, $\overline{LM}$, $\overline{LA}$; data transparent	7,8	All			
Register control pulse width	t_{PW}	for data transfer, see figure 4	9,10,11	All	200		ns
Register control data set up time	t_{su}	before data transfer, see figure 4	9,10,11	All	50		ns

See footnotes at end of table.

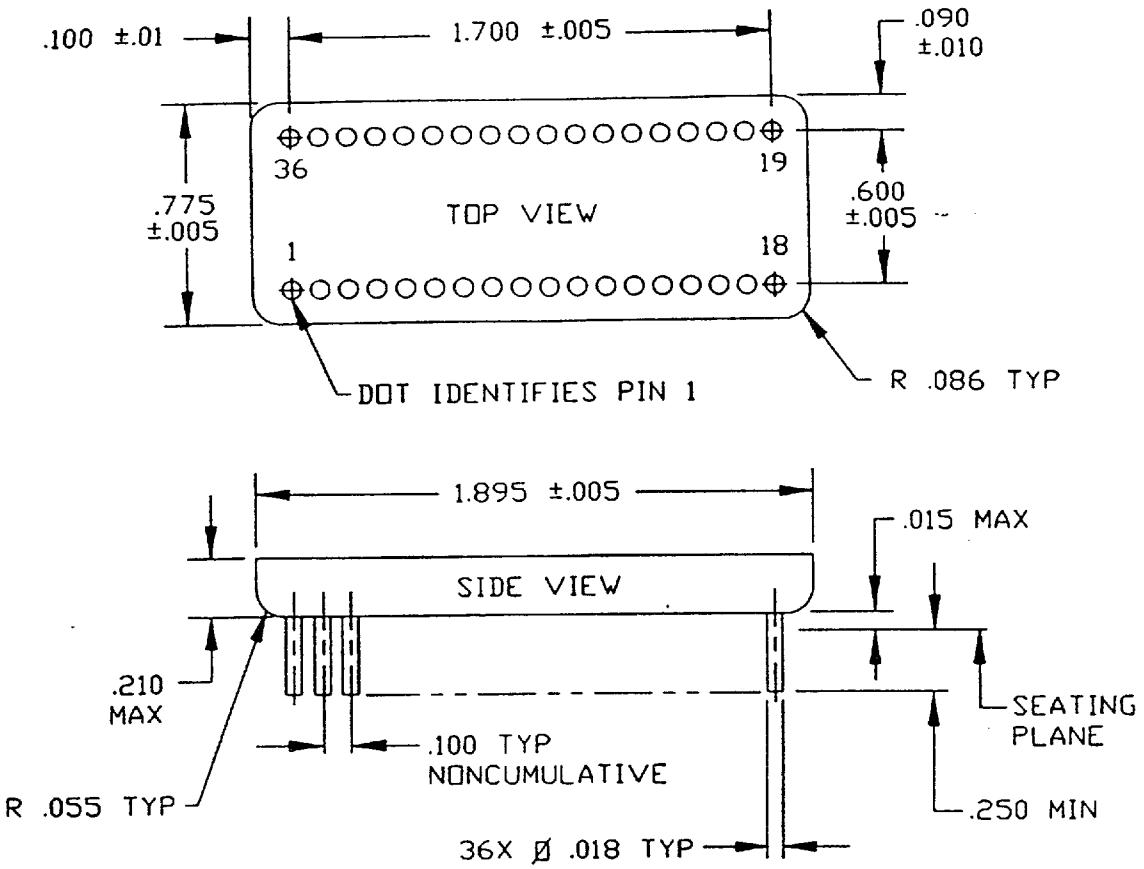
TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions 1/ $-55°C \le T_C \le +125°C$ unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Register control data hold time	t_h	hold time after low edge of LL, LM, LA, see figure 4	9,10,11	All	100		ns
Positive supply current (V_{CC})	I_{CC}	V_{CC} = +15 V dc	1,2,3	All		+20	mA
Negative supply current (V_{EE})	I_{EE}	V_{EE} = -15 V dc	1,2,3	All		-20	mA

1/ +14.25 V dc $\le V_{CC} \le$ +15.75 V dc
-14.25 V dc $\le V_{EE} \le$ -15.75 V dc

2/ Parameter shall be tested as part of device initial characterization and after design and process changes. Parameter shall be guaranteed to the limits specified in table I for all lots not specifically tested.

3/ Radius accuracy is defined as the simultaneous amplitude variation in both outputs as a function of digital angle.



Inches	mm	Inches	mm
.015	.38	.210	5.33
.018	.46	.250	6.35
.055	1.40	.600	15.24
.086	2.18	.775	19.69
.090	2.29	1.700	43.18
.100	2.54	1.895	48.13

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for information only.
3. Lead identification numbers are for reference only.
4. Lead spacing dimensions apply only at seating plane.

FIGURE 1. Case outline.

Device types	01,02,03, and 04	Device types	01,02,03, and 04
Case outline	X	Case outline	X
Terminal number	Terminal symbol	Terminal number	Terminal symbol
1	No connection	19	BIT-7
2	V_{CC}	20	BIT-6
3	GND	21	BIT-5
4	V_{EE}	22	BIT-4
5	No connection	23	BIT-3
6	No connection	24	BIT-2
7	-R	25	BIT-1 (MSB)
8	RL	26	BIT-15
9	RL^1 see note 1	27	BIT-16 (LSB)
10	RH	28	$\overline{LM}$
11	RH^1 see note 1	29	$\overline{LL}$
12	BIT-14	30	$\overline{LA}$
13	BIT-13	31	No connection
14	BIT-12	32	S1
15	BIT-11	33	$S2^1$ see note 2
16	BIT-10	34	$S3^1$ see note 2
17	BIT-9	35	S3 (+SIN)
18	BIT-8	36	S2 (+COS)

NOTES:
1. Programmable reference inputs.
2. Programmable synchronous outputs.

FIGURE 2. Terminal connections.

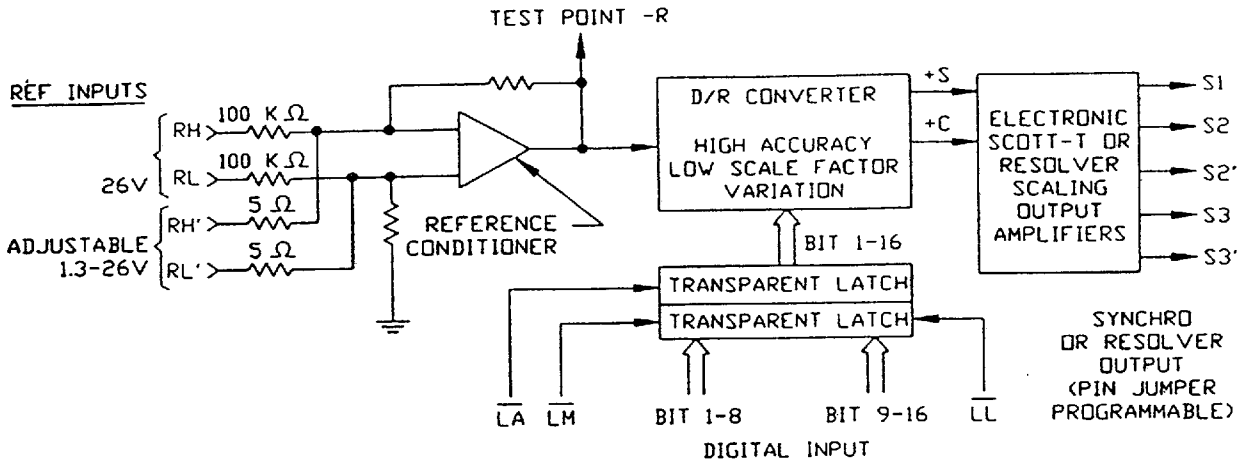


FIGURE 3. Block diagram.

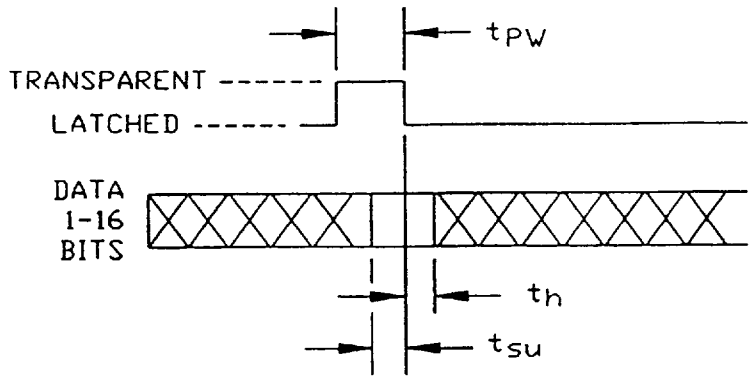


FIGURE 4. Timing diagram.

TABLE II. Electrical test requirements.

MIL-STD-883 test requirements	Subgroups (per method 5008, group A test table)
Interim electrical parameters	1,4,7,9
Final electrical test parameters	1*,2,3,4,5,6,7, 8,9,10,11
Group A test requirements	1,2,3,4,5,6,7,8, 9,10,11
Group C end-point electrical parameters	1,2,3,4,5,6,7,8, 9,10,11
Group E end-point electrical parameters for RHA devices	Subgroups ** (per method 5005, group A test table)

*PDA applies to subgroup 1.
**When applicable to this standardized military drawing, the subgroups shall be defined.

4.3 Quality conformance inspection. Quality conformance inspection shall be in accordance with MIL-H-38534 and as specified herein.

4.3.1 Group A inspection. Group A inspection shall be in accordance with MIL-H-38534 and as follows:

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

4.3.2 Group B inspection. Group B inspection shall be in accordance with MIL-H-38534.

4.3.3 Group C inspection. Group C inspection shall be in accordance with MIL-H-38534 and as follows:

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 D using the circuit submitted with the certificate of compliance (see 3.7 herein).

(2) T_A as specified in accordance with table I of method 1005 of MIL-STD-883.

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

4.3.4 Group D inspection. Group D inspection shall be in accordance with MIL-H-38534.

4.3.5 Group E inspection. Group E inspection is required only for parts intended to be marked as radiation hardness assured (see 3.5 herein). RHA levels for device classes H and K shall be M, D, R, and H. RHA quality conformance inspection sample tests shall be performed at the RHA level specified in the acquisition document.

a. RHA tests for device classes H and K for levels M, D, R, and H shall be performed through each level to determine at what levels the devices meet the RHA requirements. These RHA tests shall be performed for initial qualification and after design or process changes which may affect the RHA performance of the device.

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

c. Prior to total dose irradiation, each selected sample shall be assembled in its qualified package. It shall pass the specified group A electrical parameters in table I for subgroups specified in table II herein.

d. For device classes H and K, the devices shall be subjected to radiation hardness assured tests as specified in MIL-H-38534 for RHA level being tested, and meet the postirradiation end-point electrical parameter limits as defined in table I at T_A = +25°C ±5 percent, after exposure.

e. Prior to and during total dose irradiation testing, the devices shall be biased to establish a worst case condition as specified in the radiation exposure circuit.

f. For device classes H and K, subgroups 1 and 2 in table V, method 5005 of MIL-STD-883 shall be tested as appropriate for device construction.

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

5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-H-38534.

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.

6.2 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 microelectronic devices (FSC 5962) should contact DESC-ECT, telephone (513) 296-6047.

6.5 Comments. Comments on this drawing should be directed to DESC-ECT, Dayton, Ohio 45444, or telephone (513) 296-5374.

6.6 One part - one part number system. The one part - one part number system described below has been developed to allow for transitions between identical generic devices covered by the four major microcircuit requirements documents (MIL-M-38510, MIL-H-38534, MIL-I-38535, and 1.2.1 of MIL-STD-883) without the necessity for the generation of unique PIN's. The four military requirements documents represent different class levels, and previously when a device manufacturer upgraded military product from one class level to another, the benefits of the upgraded product were unavailable to the Original Equipment Manufacturer (OEM), that was contractually locked into the original unique PIN. By establishing a one part number system covering all four documents, the OEM can acquire to the highest class level available for a given generic device to meet system needs without modifying the original contract parts selection criteria.

Military documentation format	Example PIN under new system	Manufacturing source listing	Document listing
New MIL-M-38510 Military Detail Specifications (in the SMD format)	5962-XXXXXZZ(B or S)YY	QPL-38510 (Part 1 or 2)	MIL-BUL-103
New MIL-H-38534 Standardized Military Drawings	5962-XXXXXZZ(H or K)YY	QML-38534	MIL-BUL-103
New MIL-I-38535 Standardized Military Drawings	5962-XXXXXZZ(Q or V)YY	QML-38535	MIL-BUL-103
New 1.2.1 of MIL-STD-883 Standardized Military Drawings	5962-XXXXXZZ(M)YY	MIL-BUL-103	MIL-BUL-103

6.7 Sources of supply for device classes H and K. Sources of supply for device classes H and K are listed in QML-38534. The vendors listed in QML-38534 have submitted a certificate of compliance (see 3.7 herein) to DESC-ECT and have agreed to this drawing.

TABLE III. Pin function, case X (dual-in-line).

Function	Pin	Description
GND	3	Power supply ground, digital ground, and analog signal ground.
BIT 1-16	12-27	Digital input bits, BIT 1 = MSB = 180 degrees, BIT 16 = LSB = .0055 degrees.
$\overline{LM}$	28	High byte enable (BIT 1-8) for MSB's 8-bit input register. Logic high enables, logic low holds.
$\overline{LL}$	29	Low byte enable (BIT 9-16) for LSB's 8-bit input Logic high enables, logic low holds.
$\overline{LA}$	30	Logic high transfers 8-bit input registers data into 16-bit holding register. Logic high enables, logic low holds.
V_{CC}, V_{EE}	2,4	+15 V and -15 V supply voltages. CAUTION: Reversal of power supplies will damage the device.
RH, RL	8,10	26 V rms reference input.
RH^1, RL^1	9,11	Programmable reference input. Used to scale the output for other reference voltage levels.
S1, $S2^1$, $S3^1$	32-34	Synchro outputs.
S3 (+SIN), S2 (+COS)	35,36	Resolver output with respect to ground.
-R	7	Test point (buffered reference).
NC	1,5,6,31	No connection.