

REVISIONS

LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED
A	Add device types 05 through 08. Add vendor CAGE 09059. Editorial changes throughout.	91-11-12	Gregory Lude
B	Add case outline Y. Rewrite entire document.	93-06-11	K. A. Cottongim
C	Made changes to table I for tests Drive capability (IX), AC error, DC velocity voltage, and Filtered dc error. Changed terminal symbol for terminal number 23 in figure 2.	93-11-09	K. A. Cottongim

THE ORIGINAL FIRST PAGE OF THIS DRAWING HAS BEEN REPLACED.

REV																					
SHEET																					
REV	B	B	B																		
SHEET	15	16	17																		
REV STATUS OF SHEETS				REV	C	B	B	B	C	C	C	B	B	B	C	B	B	B			
				SHEET	1	2	3	4	5	6	7	8	9	10	11	12	13	14			
PMIC N/A				PREPARED BY Steve L. Duncan				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				CHECKED BY Robert M. Heber				MICROCIRCUIT, LINEAR, SYNCHRO-TO-DIGITAL CONVERTER, HYBRID													
				APPROVED BY William K. Heckman																	
				DRAWING APPROVAL DATE 90-10-19				SIZE A	CAGE CODE 67268	5962-90707											
				REVISION LEVEL C				SHEET	1	OF	17										

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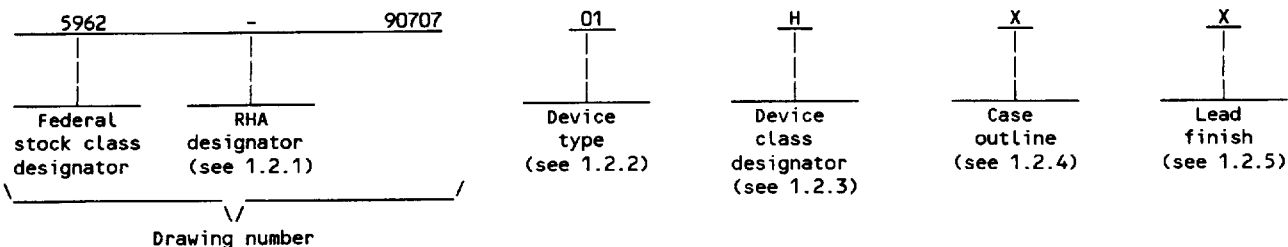
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1. SCOPE

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 (± 1.0 LSB)
01	SDC14500-635	400 Hz, 11.8 V, Synchro-to-digital converter	± 2.6 arc minutes
01	HSDC-8917II-1-A	400 Hz, 11.8 V, Synchro-to-digital converter	± 2.6 arc minutes
02	SDC14500-636	400 Hz, 11.8 V, Synchro-to-digital converter	± 4.0 arc minutes
02	HSDC-8917II-1	400 Hz, 11.8 V, Synchro-to-digital converter	± 4.0 arc minutes
03	SDC14502-605	60 Hz, 90 V, Synchro-to-digital converter	± 2.6 arc minutes
03	HSDC-8919II-1-A	60 Hz, 90 V, Synchro-to-digital converter	± 2.6 arc minutes
04	SDC14502-606	60 Hz, 90 V, Synchro-to-digital converter	± 4.0 arc minutes
04	HSDC-8919II-1	60 Hz, 90 V, Synchro-to-digital converter	± 4.0 arc minutes
05	HSD1024-C672H/2	400 Hz, 11.8 V, Synchro-to-digital converter	± 2.6 arc minutes
06	HSD1024-C673S/2	400 Hz, 11.8 V, Synchro-to-digital converter	± 4.0 arc minutes
07	HSD1024-C674H/2	60 Hz, 90 V, Synchro-to-digital converter	± 2.6 arc minutes
08	HSD1024-C675S/2	60 Hz, 90 V, Synchro-to-digital converter	± 4.0 arc minutes

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

<u>Device class</u>	<u>Device requirements documentation</u>
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 MIL-STD-1835 and as follows:

Outline letter	Descriptive designator	Terminals	Package style
X	See figure 1	36	Dual-in-line
Y	See figure 1	36	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.

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1.3 Absolute maximum ratings. 1/

Supply voltage (V_S)	+18 V dc
Logic input voltage (V_L)	+15 V dc
Reference input	130 V rms
Digital inputs range	-0.3 V dc to V_L
Power dissipation (P_D):	
Device types 01-04	270 mW 2/
Device types 05-08	380 mW 2/
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})	28°C/W
Junction temperature (T_J)	150°C

1.4 Recommended operating conditions.

Supply voltage range (V_S)	+11 V dc to +16.5 V dc
Logic input voltage range (V_L)	+4.5 V dc to +15 V supply
Ambient operating temperature range (T_A)	-55°C to +125°C

2. APPLICABLE DOCUMENTS

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

SPECIFICATION

MILITARY

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.
- MIL-STD-1835 - Microcircuit Case Outlines.

HANDBOOK

MILITARY

MIL-HDBK-780 - Standardized Military Drawings.

(Copies of the specification, 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.)

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.

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/ Power dissipation applies up to $T_A = +125^\circ\text{C}$.

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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 on 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 Digital angle outputs. The digital angle outputs 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 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 maintain the electrical test data (variables format) 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. This data shall be maintained under document revision level control by the manufacturer and be made available to the preparing activity (DESC-EC) upon request.

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-EC 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 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 either DESC-EC or the acquiring activity upon request. Also, 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 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.

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TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions ^{1/} -55°C ≤ T _A ≤ +125°C unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Resolution control		14 bits fail/pass	7,8	ALL			
Output accuracy		Measured at angles 0, 15, 30, 45, 60, 75, 90, 105, 120, 135, 150, 165, 180, 225, 270, and 315 degrees	7,8	ALL		^{2/}	
Reference input							
Input voltage range	V _{IN}		4,5,6	ALL	4.0	130	V rms
Carrier frequency			4,5,6	01,02, 05,06	360	1000	Hz
				03,04, 07,08	47	1000	
Input impedance ^{3/}	Z _{INREF}	Single ended	4,5,6	ALL	250		kΩ
		Differential			500		
Common mode voltage range ^{3/}	V _{CMREF}		4,5,6	ALL	-210	+210	V(pk)
Signal input							
Common mode range ^{3/}	V _{CM SIG}		4,5,6	01,02, 05,06	-60	+60	V(pk)
				03,04, 07,08	-182	+182	
Input impedance ^{3/}	Z _{INSIG}	Line to line	4,5,6	01,02, 05,06	17.5		kΩ
				03,04, 07,08	130		
		Each line to ground		01,02, 05,06	11.5		kΩ
				03,04, 07,08	8.5		

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	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Signal input - Continued.							
Line to line input voltage	V _{INL-L}	Line-to-line	4,5,6	01,02, 05,06	10.62	12.98	V rms
				03,04, 07,08	81	99	
Digital outputs (bits 1 through 14 and converter busy)							
Drive capability	V _{OL}	Logic 0, 1 TTL load at -1.6 mA	1,2,3	ALL		0.4	V dc
	V _{OH}	Logic 1, 10 TTL loads at 0.4 mA	1,2,3	ALL	2.8		V dc
	I _X	High impedance load, bits 1 through 14 only	1,2,3	ALL	-10	+10	μA
Converter busy	CB	Positive pulse	9,10,11	ALL	0.5	2.0	μs
Analog output							
AC error ^{3/}	e	For ±1.0 LSB change, near null to ground	4,5,6	01,02, 03,04	12.8	19.2	mV rms/LSB
				05,06, 07,08	11.0	21.0	
DC velocity voltage ^{3/}	⊖	At 2.1 rps	4,5,6	01,02, 05,06	0.8	1.2	V dc
		At 0.54 rps	4,5,6	03,04, 07,08	0.8	1.2	V dc
Filtered dc error ^{3/}	E	Per + lsb of error	4,5,6	01,02, 03,04	-1.2	-0.8	V dc
				05,06, 07,08	-1.3	-0.7	
Velocity ^{4/}	v	Full scale max., positive direction	4,5,6	ALL	3.72	5.70	V dc
		Full scale max., negative direction	4,5,6	ALL	-3.73	-5.70	V dc

See footnotes at end of table.

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TABLE I. Electrical performance characteristics - Continued.

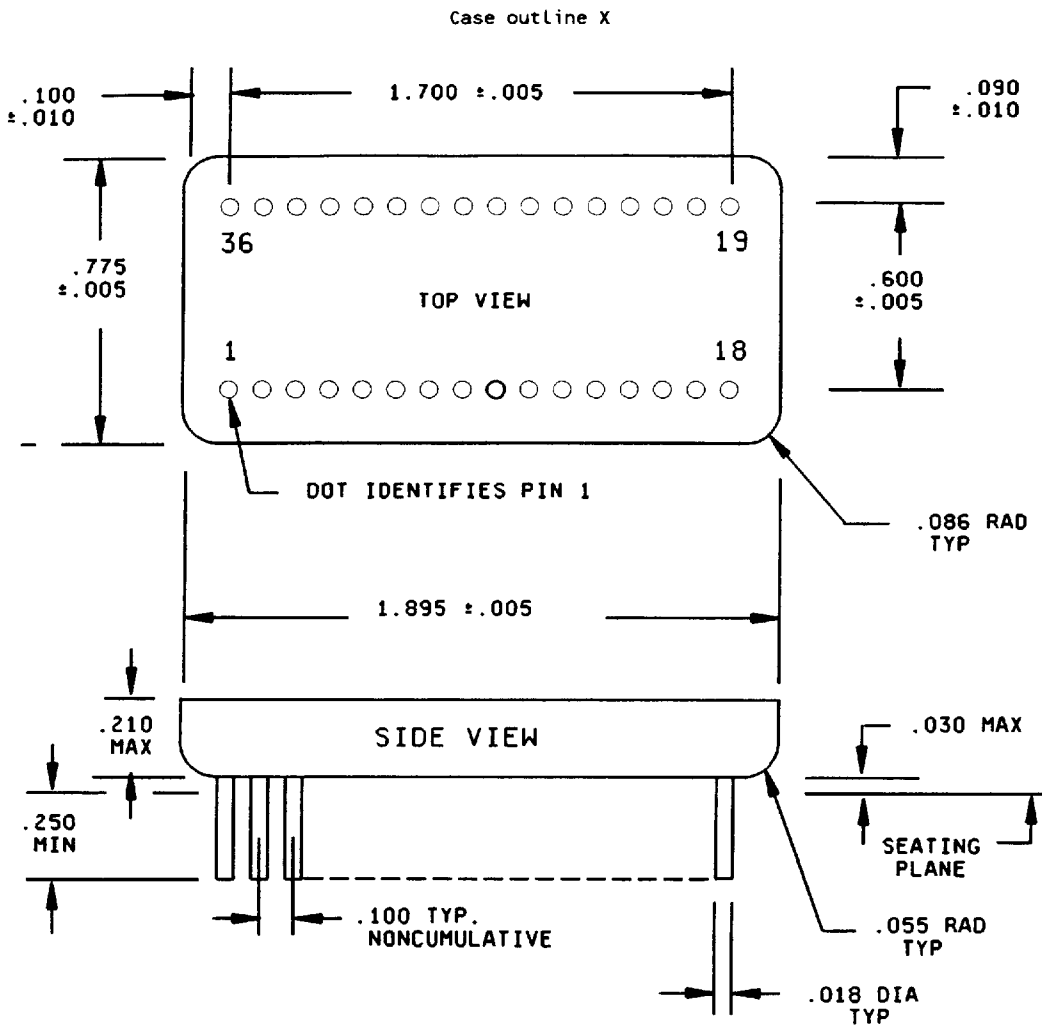
Test	Symbol	Conditions ^{1/} -55°C ≤ T _A ≤ +125°C unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Digital inputs (INH, EN 1-6, EN 7-14) on digital bits 1 through 14 while operating in CT mode							
Voltage inputs	V _{IL}	Logic 0, V _L = 5.0 V dc	1,2,3	01,02, 03,04		1.5	V dc
				05,06, 07,08		0.8	
	V _{IH}	Logic 1, V _L = 5.0 V dc	1,2,3	ALL	3.5		V dc
Loading	I _{LOAD}	(internal pull-up)	1,2,3	01,02, 03,04	-1.0	-10	μA
				05,06, 07,08	-30	+30	
Inhibit	INH		7,8 ^{5/}	ALL			
Enable bits 1 to 6	EM		7,8 ^{6/}	ALL			
Enable bits 7 to 14	EL		7,8 ^{6/}	ALL			
Set	S		7,8 ^{7/}	ALL			
Power supplies							
Supply current	I _S	Logic 0, V _S = 16.5 V dc	1,2,3	01,02, 03,04		15	mA
				05,06, 07,08		25	
Logic supply current	I _L	V _L = 5.0 V dc	1,2,3	ALL		1.0	mA

- ^{1/} V_S = +11 V dc to +16.5 V dc, V_L = +4.5 V dc to +15 V dc supply.
- ^{2/} Output accuracy for device type 01, 03, 05, and 07 is ±2.6 arc minutes ±1.0 LSB and output accuracy for device type 02, 04, 06, and 08 is ±4.0 arc minutes ±1.0 LSB. Accuracy applies at nominal voltage and frequency ± 10 percent.
- ^{3/} 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.
- ^{4/} Test is performed at full speed of 10 rps for device types 01, 02, 05, and 06 and 2.5 rps for device types 03, 04, 07, and 08.
- ^{5/} Test should verify no digital angles change while INH is logic 0 and analog input is rotating.
- ^{6/} Test should verify logic 0 enables, logic 1 high impedance.
- ^{7/} Test should verify logic 0 for use in CT mode. This pin is a no connect for device types 05, 06, 07, and 08.

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Inches	mm	Inches	mm
.005	0.13	.100	2.54
.010	0.25	.210	5.33
.018	0.46	.250	6.35
.030	0.76	.600	15.24
.055	1.40	.775	19.69
.086	2.18	1.700	43.18
.090	2.29	1.895	48.13

NOTES:

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

FIGURE 1. Case outline(s).

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Case outline Y

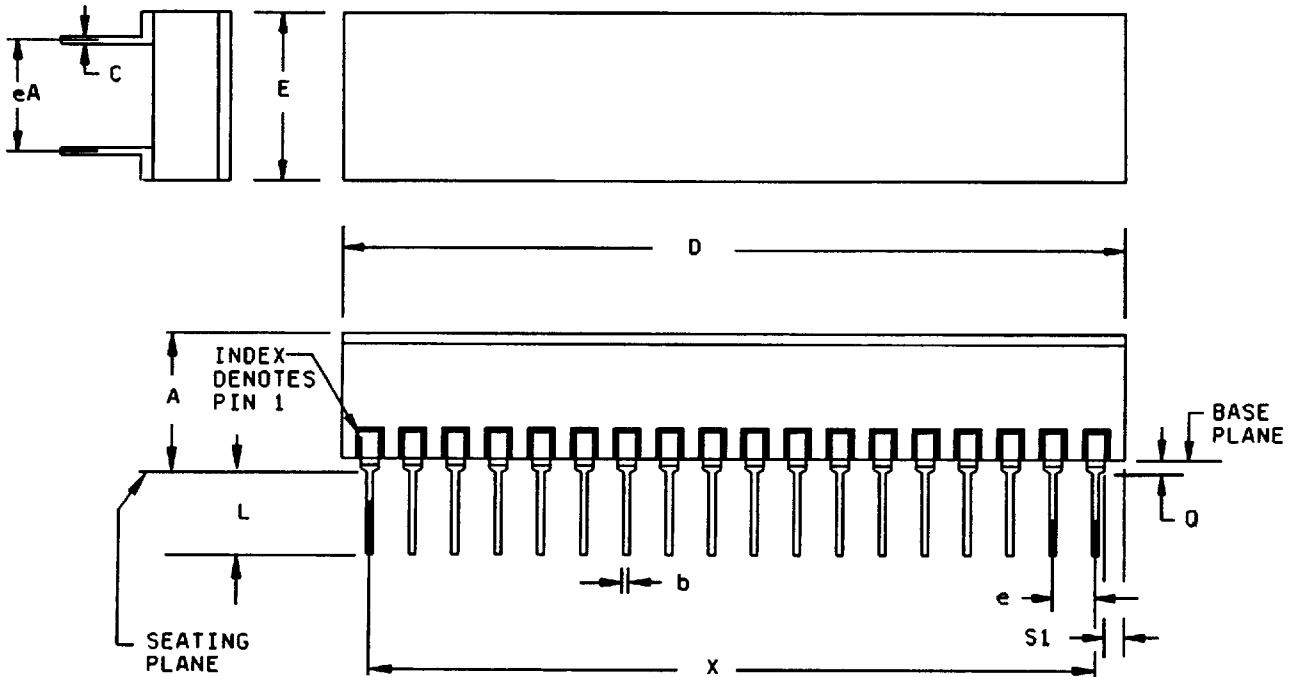


FIGURE 1. Case outline(s) - Continued.

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Case outline Y - Continued.

Symbol	Millimeters		Inches	
	Min	Max	Min	Max
A		5.33		0.210
b	0.41	0.51	0.016	0.020
c	0.41	0.51	0.016	0.020
D		48.26		1.900
E		20.32		0.800
e	2.54 BSC		0.100 BSC	
eA	15.11	15.37	0.595	0.605
L	6.10	6.60	0.240	0.260
Q		0.72		0.030
S1	2.18	2.44	0.086	0.096
X	43.18 BSC		1.700 BSC	

NOTES:

1. The U.S. preferred system of measurement is the metric SI. This item was designed using inch-pound units of measurement. In case of problems involving conflicts between the metric and inch-pound units, the inch-pound units shall rule.

FIGURE 1. Case outline(s) - Continued.

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Device types	ALL	Device types	ALL
Case outlines	X and Y	Case outlines	X and Y
Terminal number	Terminal symbol	Terminal number	Terminal symbol
1	S1	19	RH (reference high)
2	S2	20	RL (reference low)
3	S3	21	NC
4	NC	22	E (filtered dc error out)
5	BIT 1 MSB	23	$\hat{\theta}$ (analog velocity out)
6	BIT 2	24	CB (converter busy)
7	BIT 3	25	EN 7-14 (enable, bits 7-14)
8	BIT 4	26	EN 1-6 (enable, bits 1-6)
9	BIT 5	27	e (AC error out)
10	BIT 6	28	V _L (logic voltage input)
11	BIT 7	29	GND
12	BIT 8	30	S (see note)
13	BIT 9	31	Ge (gain control)
14	BIT 10	32	V _S (power supply in)
15	BIT 11	33	INH (inhibit)
16	BIT 12	34	V _{REF} (internal dc reference)
17	BIT 13	35	BC (buffered cosine)
18	BIT 14 LSB	36	BS (buffered sine)

NOTES:

- 1/ Pin 30 is a no connect (NC) for device types 05, 06, 07, and 08.
- 2/ BC and BS pins are used in other applications.
- 3/ NC = no connect.

FIGURE 2. Terminal connections.

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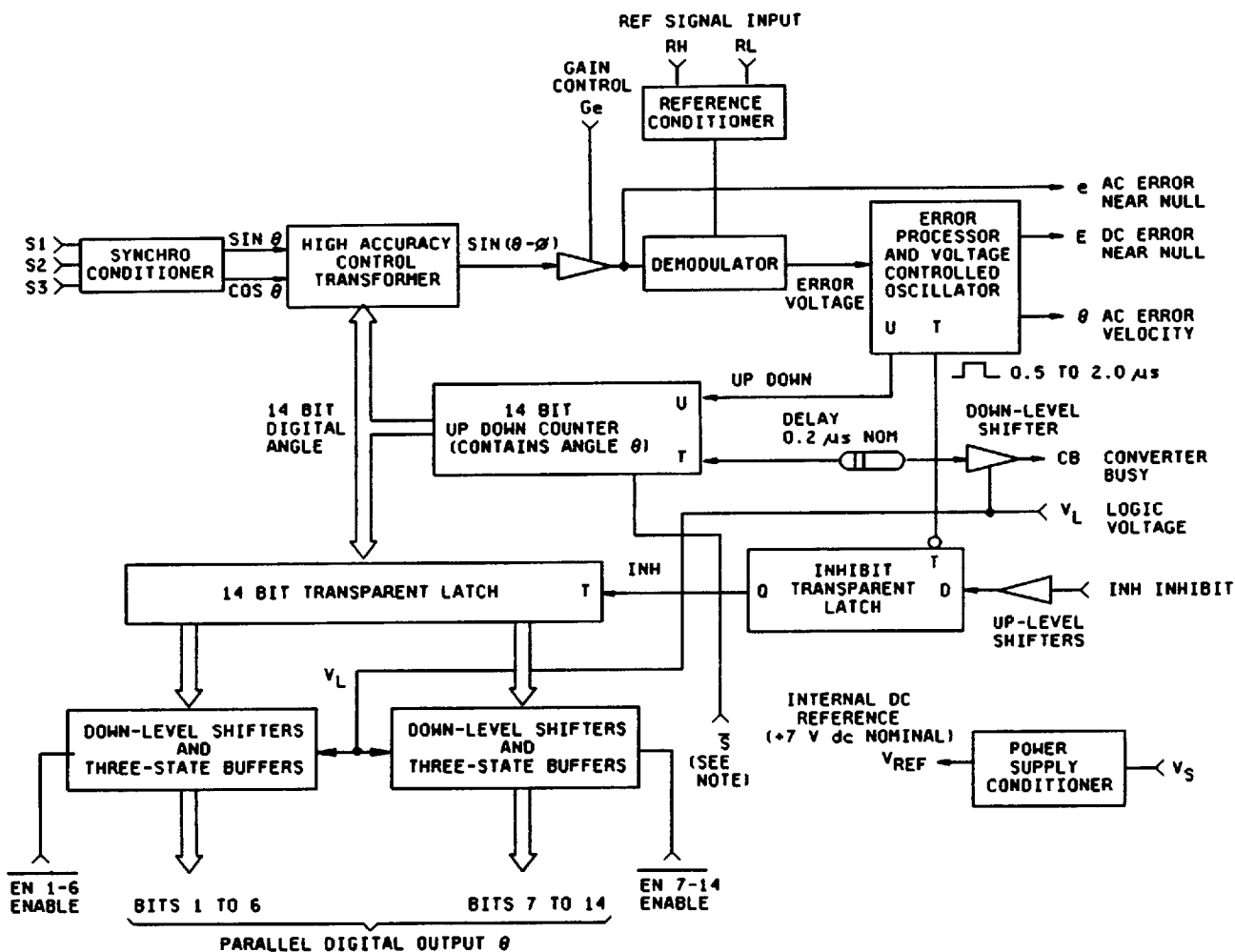


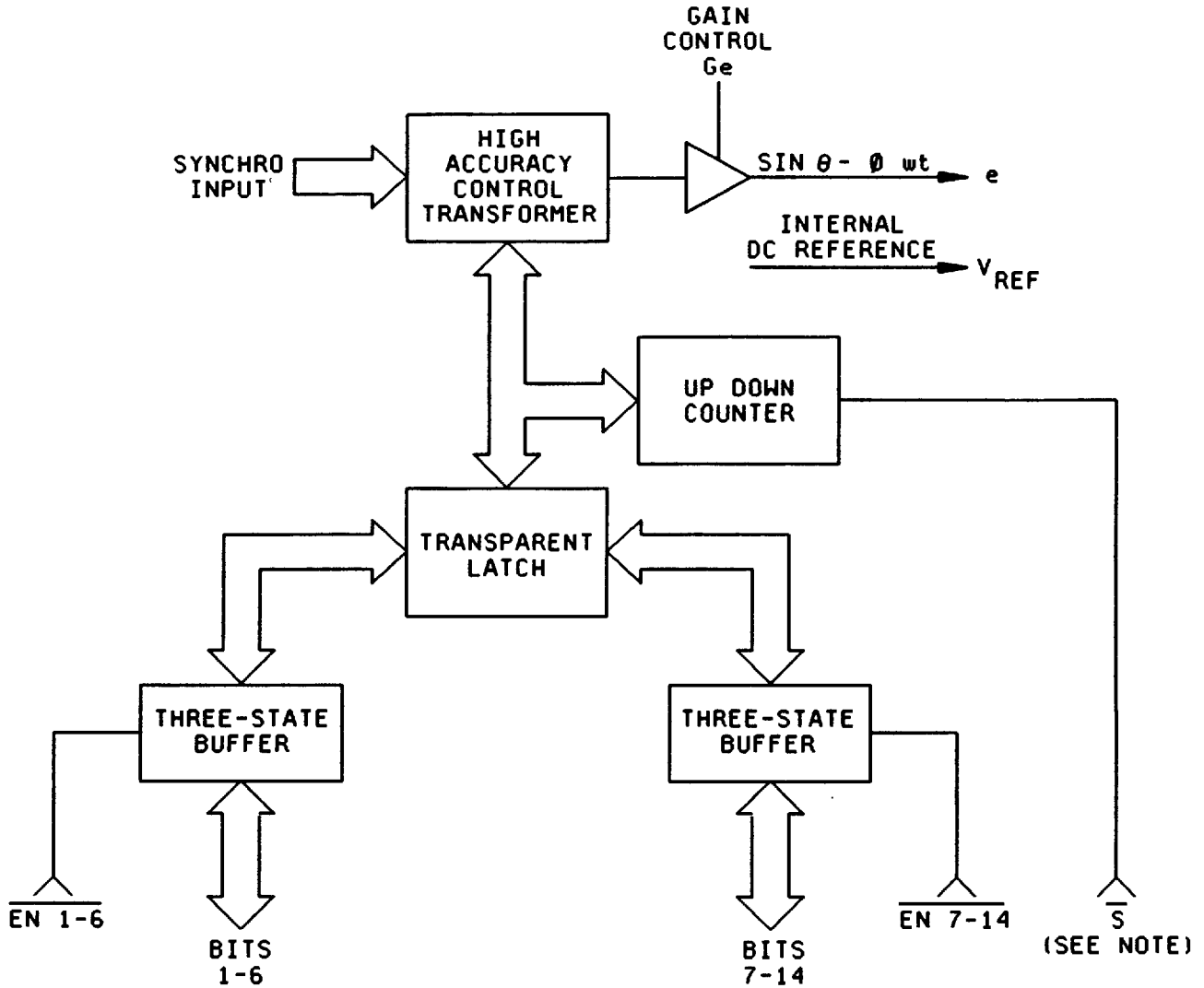
FIGURE 3. Block diagram(s).

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CONTROL TRANSFORMER MODE



NOTE: No connection for devices types 05, 06, 07, and 08.

FIGURE 3. Block diagram(s) - Continued.

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Bit	Degree per bit	Minute per bit
1 MSB	180	10,800
2	90	5,400
3	45	2,700
4	22.5	1,350
5	11.25	675
6	5.625	387.5
7	2.813	168.75
8	1.405	84.38
9	0.7031	42.19
10	0.3516	21.09
11	0.1758	10.55
12	0.0879	5.27
13	0.0439	2.64
14 LSB	0.0220	1.32

FIGURE 4. Digital angle output(s).

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TABLE II. Electrical test requirements.

MIL-H-38534 test requirements	Subgroups (in accordance with MIL-H-38534, 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	1,21,3,4,5,6,7,8,9,10,11
MIL-STD-883, group E end-point electrical parameters for RHA devices	Subgroups ** (in accordance with 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 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, method 1005 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 either DESC-EC or the acquiring activity upon request. Also, 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.

(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.

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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 $T_A = +25^\circ\text{C} \pm 5$ 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-EC, telephone (513) 296-6047.

6.5 Comments. Comments on this drawing should be directed to DESC-EC, Dayton, Ohio 45444, or telephone (513) 296-5373.

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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.

<u>Military documentation format</u>	<u>Example PIN under new system</u>	<u>Manufacturing source listing</u>	<u>Document Listing</u>
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-EC and have agreed to this drawing.

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