

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

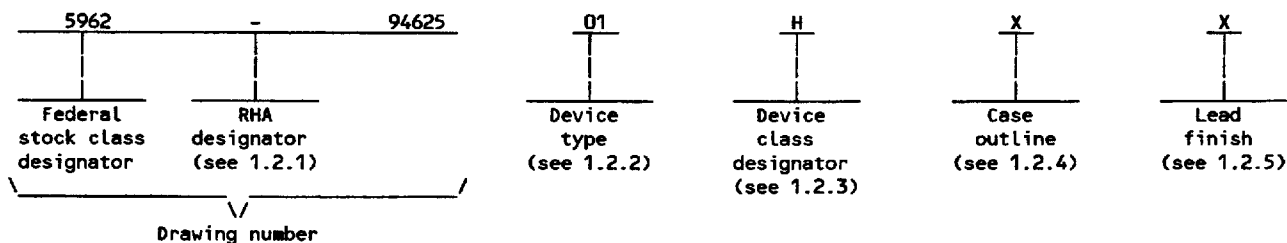
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5962-E343-94  
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## 1. SCOPE

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:

<u>Device type</u>	<u>Generic number</u>	<u>Circuit function</u>
01	ATR2812S/CH	DC/DC converter, 30 W, 12 V output

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:

<u>Outline letter</u>	<u>Descriptive designator</u>	<u>Terminals</u>	<u>Package style</u>
X	See figure 1	10	Dual-in-line
Z	See figure 1	10	Flange mount

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/

Input voltage range . . . . . -0.5 V dc to +50 V dc  
Power dissipation ( $P_D$ ) . . . . . 14 W  
Lead temperature (soldering, 10 seconds) . . . . . +300°C  
Storage temperature range . . . . . -65°C to +150°C

### 1.4 Recommended operating conditions.

Input voltage range . . . . . +16 V dc to +40 V dc  
Output power 2/ . . . . .  $\leq 30$  W  
Case operating temperature range ( $T_C$ ) . . . . . -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-883 - Test Methods and Procedures for Microelectronics.  
MIL-STD-973 - Configuration Management.  
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/ Derate output power linearly above case temperature +125°C to 0 at +135°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 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.

3.3 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.

(2)  $T_C$  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 -55°C ≤ T <sub>C</sub> ≤ +125°C V <sub>IN</sub> = 28 V dc ±5%, C <sub>L</sub> = 0 unless otherwise specified	Group A subgroups	Device types	Limits		Unit
					Min	Max	
Output voltage	V <sub>OUT</sub>	I <sub>OUT</sub> = 0	1	01	11.88	12.12	V
			2,3		11.70	12.30	
Output current 1/	I <sub>OUT</sub>	V <sub>IN</sub> = 16, 28, and 40 V dc	1,2,3	01		2500	mA
Output ripple 2/ voltage	V <sub>RIP</sub>	V <sub>IN</sub> = 16, 28, and 40 V dc B.W. = 20 Hz to 2 MHz	1,2,3	01		60	mV p-p
Line regulation 3/	V <sub>RLINE</sub>	V <sub>IN</sub> = 16, 28, and 40 V dc I <sub>OUT</sub> = 0, 1250, and 2500 mA	1	01		±30	mV
			2,3			±60	
Load regulation 3/	V <sub>RLOAD</sub>	V <sub>IN</sub> = 16, 28, and 40 V dc I <sub>OUT</sub> = 0, 1250, and 2500 mA	1	01		±60	mV
			2,3			±120	
Input current	I <sub>IN</sub>	I <sub>OUT</sub> = 0, inhibit (pin 2) tied to input return (pin 10)	1,2,3	01		18	mA
			1			50	
		I <sub>OUT</sub> = 0, inhibit (pin 2) = open	2,3			75	
Input ripple 2/ current	I <sub>RIP</sub>	I <sub>OUT</sub> = 2500 mA B.W. = 20 Hz to 2 MHz	1,2,3	01		50	mA p-p
Efficiency	E <sub>FF</sub>	I <sub>OUT</sub> = 2500 mA	1	01	80		%
			2,3		75		
Isolation	ISO	Input to output or any pin to case (except pin 8) at 500 V dc, T <sub>C</sub> = +25°C	1	01	100		MΩ
Capacitive 4/ 5/ load	C <sub>L</sub>	No effect on dc performance T <sub>C</sub> = +25°C	4	01		500	μf
Power dissipation load fault	P <sub>D</sub>	Overload, T <sub>C</sub> = +25°C 6/	1	01		12	W
		Short circuit	1,2,3			9	

See footnotes at end of table.

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TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions -55°C ≤ T <sub>C</sub> ≤ +125°C V <sub>IN</sub> = 28 V dc ±5%, C <sub>L</sub> = 0 unless otherwise specified	Group A Subgroups	Device types	Limits		Unit
					Min	Max	
Switching frequency	F <sub>S</sub>	I <sub>OUT</sub> = 2500 mA	4,5,6	01	500	600	kHz
Sync frequency range	F <sub>sync</sub>	I <sub>OUT</sub> = 2500 mA	4,5,6	01	500	700	kHz
Output response to step transient load changes <u>7/</u>	V <sub>O</sub> T <sub>LOAD</sub>	1250 mA to/from 2500 mA	4,5,6	01	-800	+800	mV pk
		200 mA to/from 1250 mA	4,5,6		-1000	+1000	
Recovery time step transient load changes <u>7/</u> <u>8/</u>	T <sub>T</sub> LOAD	1250 mA to/from 2500 mA	4	01		100	μs
			5,6			200	
		200 mA to/from 1250 mA	4			100	
			5,6			200	
Output response to transient step <u>5/</u> line changes <u>9/</u>	V <sub>O</sub> T <sub>LINE</sub>	Input step 16 V to/from 40 V dc, I <sub>OUT</sub> = 2500 mA	4,5,6	01		±1200	mV pk
Recovery time <u>5/</u> transient step <u>8/</u> line changes <u>9/</u>	T <sub>T</sub> LINE	Input step 16 V to/from 40 V dc, I <sub>OUT</sub> = 2500 mA	4,5,6	01		10	ms
Turn on overshoot	V <sub>Ton</sub> os	I <sub>OUT</sub> = 0 and 2500 mA	4,5,6	01		800	mV pk
Turn on delay <u>10/</u>	T <sub>on</sub> D	I <sub>OUT</sub> = 0 and 2500 mA	4,5,6	01		25	ms
Load fault <u>5/</u> <u>10/</u> recovery	T <sub>r</sub> LF		4,5,6	01		25	ms

See footnotes at end of table.

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TABLE I. Electrical performance characteristics - Continued.

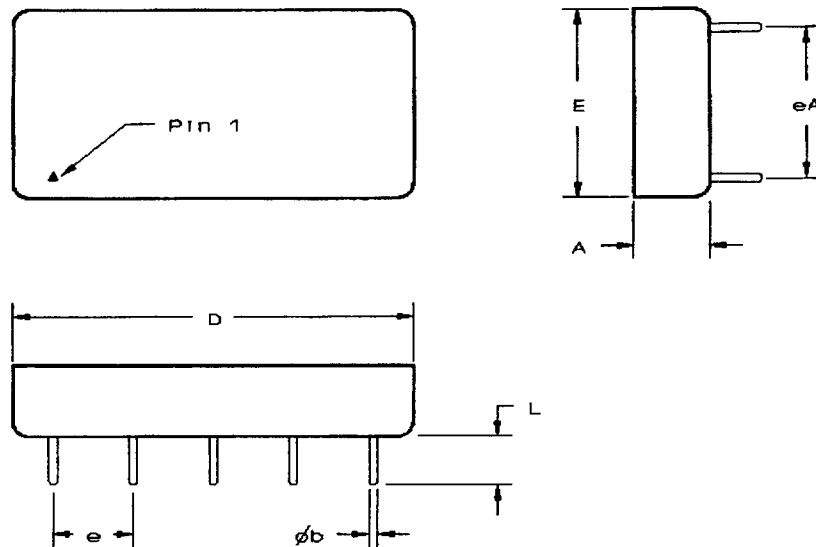
- 1/ Parameter guaranteed by line and load regulation tests.
- 2/ Bandwidth guaranteed by design. Tested for 20 kHz to 2 MHz.
- 3/ Output voltage measured at load with remote sense leads connected across load.
- 4/ Capacitive load may be any value from 0 to the maximum limit without compromising dc performance. A capacitive load in excess of the maximum limit will not disturb loop stability but may interfere with the operation of the load fault detection circuitry, appearing as a short circuit during turn on.
- 5/ Parameter shall be tested as part of design characterization and after design or process changes. Thereafter parameters shall be guaranteed to the limits specified in table 1.
- 6/ An overload is that condition with a load in excess of the rated load but less than that necessary to trigger the short circuit protection and is the condition of maximum power dissipation.
- 7/ Load step transition time between 2 and 10 microseconds.
- 8/ Recovery time is measured from the initiation of the transient to where  $V_{OUT}$  has returned to within  $\pm 1$  percent of  $V_{OUT}$  at 50 percent load.
- 9/ Input step transition time between 2 and 10 microseconds.
- 10/ Turn on delay time measurement is for either a step application of power at the input or the removal of a ground signal from the inhibit pin (pin 2) while power is applied to the input.

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# Case outline X



Symbol	Millimeters		Inches	
	Min	Max	Min	Max
A		10.29		0.405
$\phi b$	0.89	1.14	0.035	0.045
D		53.85		2.120
e	10.03	10.29	0.395	0.405
E		28.45		1.120
eA	20.19	20.45	0.795	0.805
L	6.35	6.86	0.250	0.270

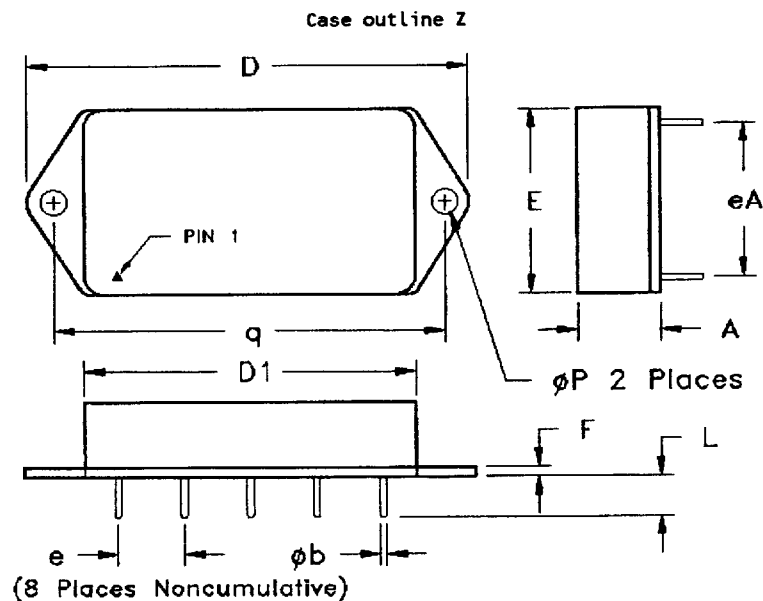
FIGURE 1. Case outline(s).

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Symbol	Millimeters		Inches	
	Min	Max	Min	Max
A		10.29		0.405
øb	0.89	1.14	0.035	0.045
D		73.15		2.880
D1		53.85		2.120
e	10.03	10.29	0.395	0.405
E		28.45		1.120
eA	20.19	20.45	0.795	0.805
F	1.22	1.52	0.048	0.060
L	6.35	6.86	0.250	0.270
øP	3.99	4.24	0.157	0.167
q	64.52	65.02	2.540	2.560

NOTES:

1. The U.S. government preferred system of measurement is the metric SI. This case outline 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.
2. Case outline X weight: 55 grams maximum.
3. Case outline Z weight: 58 grams maximum.

FIGURE 1. Case outline(s) - Continued.

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Device type	01
Case outlines	X and Z
Terminal number	Terminal symbol
1	Input
2	Inhibit input
3	Sense return
4	Output return
5	Output
6	Positive sense
7	No connection
8	Case ground
9	Sync
10	Input return

FIGURE 2. Terminal connections.

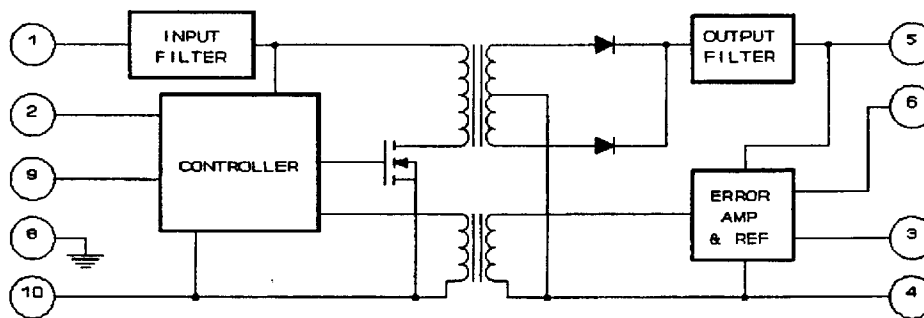


FIGURE 3. Block diagram.

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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	---
Final electrical test parameters	1*,2,3,4,5,6
Group A test requirements	1,2,3,4,5,6
Group C end-point electrical parameters	1,4
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 as follows:

- a. Tests shall be as specified in table II herein.
- b. Subgroups 7, 8, 9, 10, and 11 shall be omitted.

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)  $T_C$  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-973 using DD Form 1692, Engineering Change Proposal.

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 three major microcircuit requirements documents (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 three 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 three 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-H-38534 Standardized Military Drawings	5962-XXXXXXZ(H or K)YY	QML-38534	MIL-BUL-103
New MIL-I-38535 Standardized Military Drawings	5962-XXXXXXZ(Q or V)YY	QML-38535	MIL-BUL-103
New 1.2.1 of MIL-STD-883 Standardized Military Drawings	5962-XXXXXXZ(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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