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

REV																			
SHEET																			
REV																			
SHEET	15	16	17	18	19														
REV STATUS				REV															
OF SHEETS				SHEET		1	2	3	4	5	6	7	8	9	10	11	12	13	14

PMIC N/A	PREPARED BY Steve Duncan	DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43216
STANDARD MICROCIRCUIT DRAWING	CHECKED BY Michael Jones	
THIS DRAWING IS AVAILABLE FOR USE BY ALL DEPARTMENTS AND AGENCIES OF THE DEPARTMENT OF DEFENSE	APPROVED BY Kendall A. Cottongim	MICROCIRCUIT, HYBRID, LINEAR, 12 VOLT, SINGLE CHANNEL, DC/DC CONVERTER
	DRAWING APPROVAL DATE 98-12-03	
AMSC N/A	REVISION LEVEL	SIZE: A; CAGE CODE: 67268; 5962-94722
		SHEET 1 OF 19

DSCC FORM 2233
APR 97

5962-E067-99

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

1. SCOPE

1.1 Scope. This drawing documents five product assurance classes, class D (lowest reliability), class E, (exceptions), class G (lowest high reliability), class H (high reliability), and class K, (highest reliability) 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:

5962	-	94722	01	H	X	X
Federal stock class designator	RHA designator (see 1.2.1)		Device type (see 1.2.2)	Device class designator (see 1.2.3)	Case outline (see 1.2.4)	Lead finish (see 1.2.5)

Drawing number

1.2.1 Radiation hardness assurance (RHA) designator. Device classes H and K RHA marked devices shall meet the MIL-PRF-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) identify the circuit function as follows:

Device type	Generic number	Circuit function
01	AFL2812S/CH	DC/DC converter, 108 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:

Device class	Device performance documentation
D, E, G, H, or K	Certification and qualification to MIL-PRF-38534

1.2.4 Case outline(s). The case outline(s) are as designated in MIL-STD-1835 and as follows:

Outline letter	Descriptive designator	Terminals	Package style
U	See figure 1	12	Y case configuration with leads bent upwards
X	See figure 1	12	Straight leads with end mounting thru holes
Y	See figure 1	12	Straight leads with side mounting thru holes
Z	See figure 1	12	Y case configuration with leads bent downwards

1.2.5 Lead finish. The lead finish shall be as specified in MIL-PRF-38534.

1.3 Absolute maximum ratings. 1/

Input voltage range	-0.5 V dc to +50 V dc
Lead temperature (soldering, 10 seconds)	+300°C
Storage temperature range	-65°C to +135°C

1.4 Recommended operating conditions.

Input voltage range	+16 V dc to +40 V dc
Output power 2/	≤ 108 W
Case operating temperature range	-55°C to +125°C

2. APPLICABLE DOCUMENTS

2.1 Government specification, standards, and handbook. The following specification, standards, and handbook form a part of this drawing to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation.

SPECIFICATION

DEPARTMENT OF DEFENSE

MIL-PRF-38534 - Hybrid Microcircuits, General Specification for.

STANDARDS

DEPARTMENT OF DEFENSE

MIL-STD-883 - Test Methods and Procedures for Microelectronics.
MIL-STD-973 - Configuration Management.
MIL-STD-1835 - Microcircuit Case Outlines.

HANDBOOK

DEPARTMENT OF DEFENSE

MIL-HDBK-780 - Standard Microcircuit Drawings.

(Unless otherwise indicated, copies of the specification, standards, and handbook are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

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 takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

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.

3. REQUIREMENTS

3.1 Item requirements. The individual item performance requirements for device classes D, E, G, H, and K shall be in accordance with MIL-PRF-38534. Compliance with MIL-PRF-38534 may include the performance of all tests herein or as designated in the device manufacturer's Quality Management (QM) plan or as designated for the applicable device class. Therefore, the tests and inspections herein may not be performed for the applicable device class (see MIL-PRF-38534). Furthermore, the manufacturers may take exceptions or use alternate methods to the tests and inspections herein and not perform them. However, the performance requirements as defined in MIL-PRF-38534 shall be met for the applicable device class.

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

3.3 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 defined in table I.

3.5 Marking of Device(s). Marking of device(s) shall be in accordance with MIL-PRF-38534. The device shall be marked with the PIN listed in 1.2 herein. In addition, the manufacturer's vendor similar PIN may also be marked as listed in QML-38534.

3.6 Data. In addition to the general performance requirements of MIL-PRF-38534, the manufacturer of the device described herein shall maintain the electrical test data (variables format) from the initial quality conformance inspection group A lot sample, for each device type listed herein. Also, the data should 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 (DSCC-VA) 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 (original copy) submitted to DSCC-VA shall affirm that the manufacturer's product meets the performance requirements of MIL-PRF-38534 and herein.

3.8 Certificate of conformance. A certificate of conformance as required in MIL-PRF-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-PRF-38534 or as modified in the device manufacturer's Quality Management (QM) plan. The modification in the QM plan shall not affect the form, fit, or function as described herein.

TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions $-55°C \le T_C \le +125°C$ V_{IN} = 28 V dc ±5 %, C_L = 0 unless otherwise specified	Group A Subgroups	Device type	Limits		Unit
					Min	Max	
Output voltage	V_{OUT}	I_{OUT} = 9 A	1	01	11.88	12.12	V
			2,3		11.76	12.24	
Output current 1/	I_{OUT}	V_{IN} = 16, 28, 40 V dc	1,2,3	01		9	A
Output ripple voltage 2/	V_{RIP}	V_{IN} = 16, 28, 40 V dc B.W. = 20 Hz to 10 MHz	1,2,3	01		45	mV p-p
Line regulation 3/	VR_{LINE}	V_{IN} = 16, 28, 40 V dc I_{OUT} = 0, 4.5, and 9 A	1,2,3	01		±20	mV
Load regulation 3/	VR_{LOAD}	V_{IN} = 16, 28, 40 V dc I_{OUT} = 0, 4.5, and 9 A	1,2,3	01		±120	mV
Input current	I_{IN}	I_{OUT} = no load	1	01		80	mA
			2,3			100	
		Enable 1, (pin 4) shorted to Input return (pin 2)	1,2,3			5	
		Enable 2, (pin 12) shorted to Output return (pin 8)	1,2,3			50	
Input ripple current 2/	I_{RIP}	I_{OUT} = 9 A, B.W. = 20 Hz to 10 MHz	1,2,3	01		60	mA p-p
Efficiency	E_{FF}	I_{OUT} = 9 A	1,2,3	01	80		%
Isolation	ISO	Input to output or any pin to case (except pin 3) at 500 V dc, T_C =+25°C	1	01	100		MΩ
Maximum Capacitive load 5/	C_L	No effect on dc performance, T_C = +25°C	4	01	10,000		µF

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions $-55°C \le T_C \le +125°C$ V_{IN} = 28 V dc ±5 %, C_L = 0 unless otherwise specified	Group A Subgroups	Device type	Limits		Unit
					Min	Max	
Power dissipation load fault	P_D	Overload 6/	1,2,3	01		33	W
		Short circuit				33	
Current limit point 4/	I_{CL}	V_{OUT} = 90 % V_{NOM}	1	01	10.3	11.2	A
			2		9.45	10.3	
			3		11.2	12.6	
Switching frequency	F_S		4,5,6	01	500	600	kHz
Sync frequency range	F_{SYNC}		4,5,6	01	500	700	kHz
Output response to step transient load changes 7/	VO_{TLOAD}	50% to/from 100%	4,5,6	01	-750	+750	mV pk
		10% to/from 50%			-750	+750	
Recovery time, step transient load changes 7/ 8/	TT_{LOAD}	50% to/from 100%	4,5,6	01		200	µs
		10% to/from 50%				400	
Output response to transient step line changes 5/ 9/	VO_{TLINE}	Input step 16 V to/from 40 V dc, I_{OUT} = 9 A	4,5,6	01	-500	+500	mV pk
Recovery time transient step line changes 5/ 8/ 9/	TT_{LINE}	Input step, 16 V to/from 40 V dc, I_{OUT} = 9 A	4,5,6	01		500	µs
Turn on overshoot	$VTon_{os}$	Enable 1 and 2 on. (Pins 4 and 12 high or open)	4,5,6	01		250	mV pk
Turn on delay 10/	Ton_D	Enable 1 and 2 on. (Pins 4 and 12 high or open)	4,5,6	01		10	ms
Load fault recovery 5/	Tr_{LF}		4,5,6	01		10	ms

See footnotes at top of next page.

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 10 MHz.

3/ All electrical tests are performed with remote sense leads connected to the output lead at the output load.

4/ Current limit point is that condition of excess load causing output voltage to drop 90% of nominal.

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 I.

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 $\geq$ 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 $\geq$ 100 microseconds.

10/ Turn on delay is measured with an input voltage rise time of between 100 and 500 volts per millisecond.

Case U

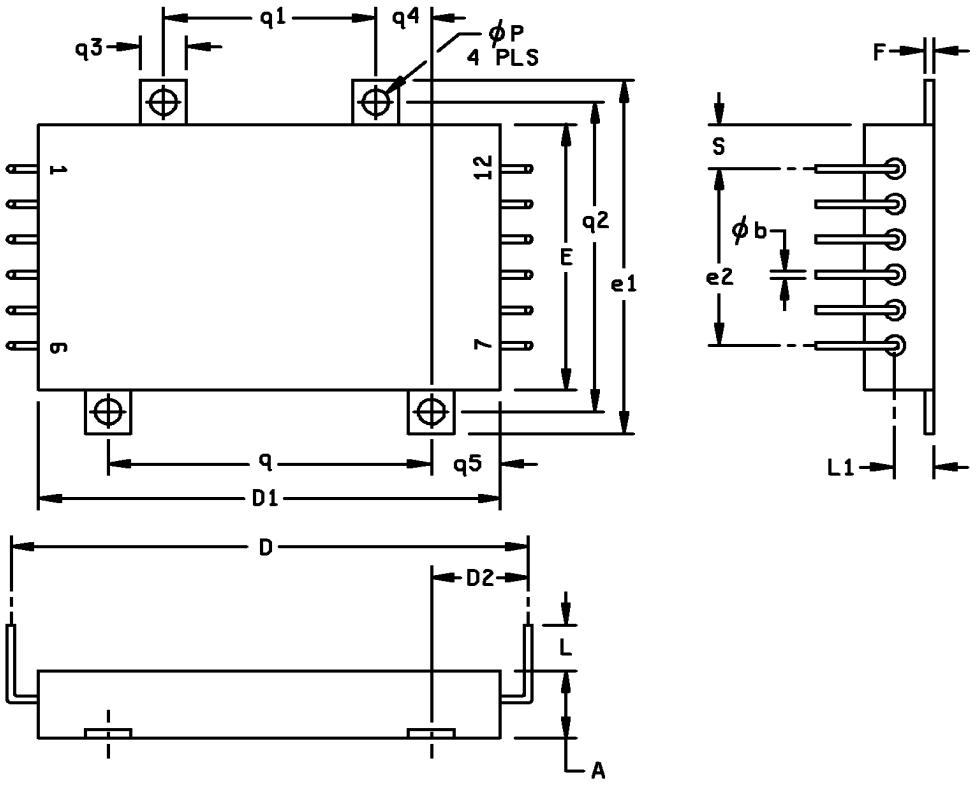

FIGURE 1. Case outline(s).

STANDARD MICROCIRCUIT DRAWING DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43216-5000	SIZE A		5962-94722
		REVISION LEVEL	SHEET 8

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Symbol	Millimeters		Inches	
	Min	Max	Min	Max
A		9.65		.380
D	71.00	71.25	2.795	2.805
D1	63.37	63.63	2.495	2.505
D2	13.21	13.46	.520	.530
E	37.97	38.23	1.495	1.505
e1	50.6	51.1	1.99	2.01
e2	25.27	25.53	.995	1.005
F	1.14	1.40	.045	.055
L	10.4	10.9	.41	.43
L1	5.46	5.72	.215	.225
q	44.32	44.58	1.745	1.755
q1	29.08	29.34	1.145	1.155
q2	44.32	44.58	1.745	1.755
q3	6.1	6.6	.24	.26
q4	7.49	7.75	.295	.305
q5	9.40	9.65	.370	.380
S	6.22	6.48	.245	.255
∅b	0.89	1.14	.035	.045
∅p	3.43	3.68	.135	.145

NOTES:
1. The U.S. government 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.
2. Lead identification for reference only.
3. Case outline weight: 92 grams maximum.

FIGURE 1. Case outline(s) - Continued.

Case X

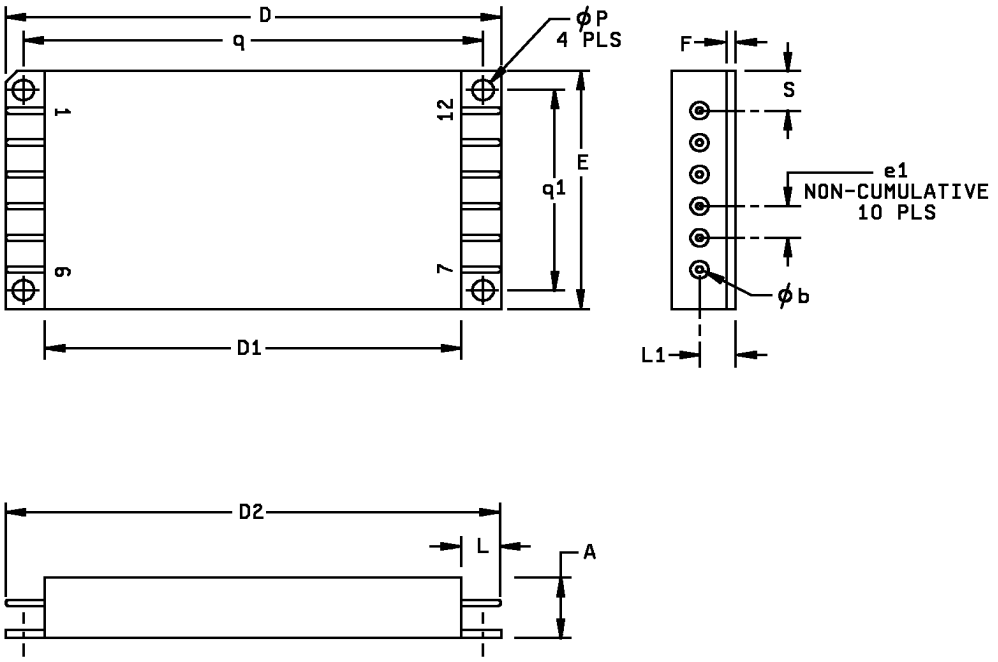

FIGURE 1. Case outline - Continued.

Symbol	Millimeters		Inches	
	Min	Max	Min	Max
A		9.65		.380
D	76.07	76.33	2.995	3.005
D1	63.37	63.63	2.495	2.505
D2		75.57		2.975
E	37.97	38.23	1.495	1.505
e1	4.95	5.21	.195	.205
F	1.14	1.40	.045	.055
L		6.05		.238
L1	5.46	5.72	.215	.225
q	69.98	70.23	2.755	2.765
q1	31.88	32.13	1.255	1.265
S	6.22	6.48	.245	.255
∅b	0.89	1.14	.035	.045
∅p	3.12	3.38	.123	.133

NOTES:
1. The U.S. government 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.
2. Lead identification for reference only.
3. Case outline weight: 92 grams maximum.

FIGURE 1. Case outline(s) - Continued.

Case Y

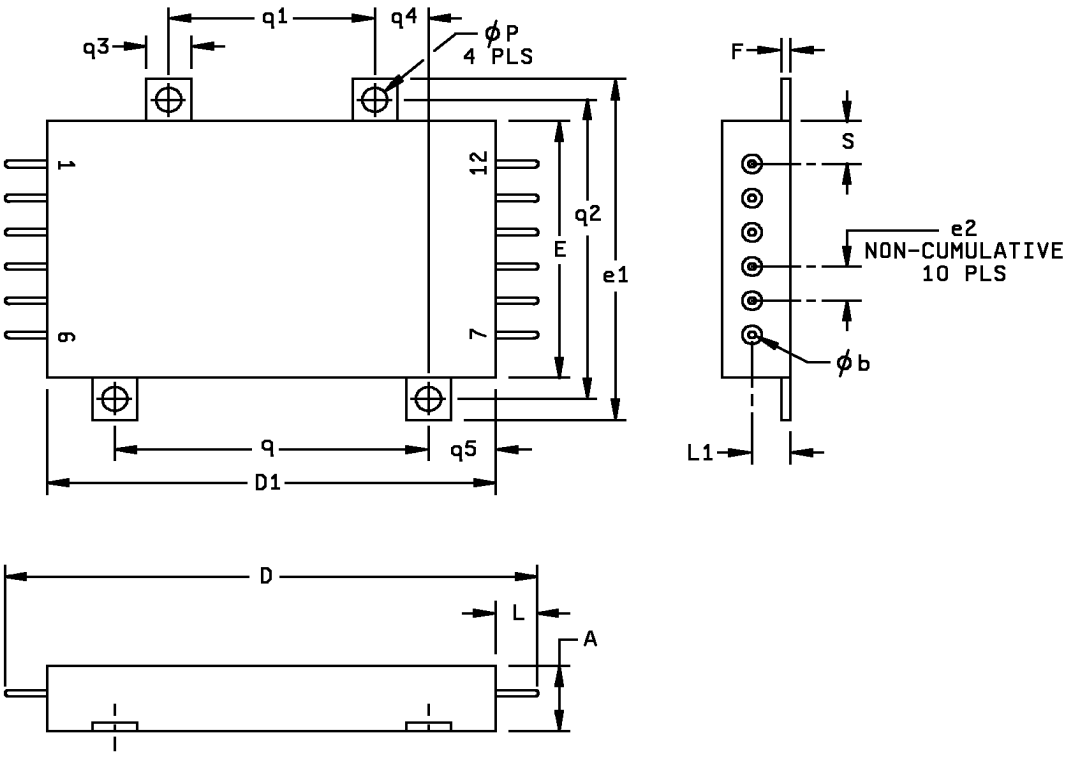

FIGURE 1. Case outline(s) – Continued.

STANDARD MICROCIRCUIT DRAWING DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43216-5000	SIZE A		5962-94722
		REVISION LEVEL	SHEET 12

DSCC FORM 2234
APR 97

Symbol	Millimeters		Inches	
	Min	Max	Min	Max
A		9.65		.380
D		75.57		2.975
D1	63.37	63.63	2.495	2.505
E	37.97	38.23	1.495	1.505
e1	50.6	51.1	1.99	2.01
e2	4.95	5.21	.195	.205
F	1.14	1.40	.045	.055
L		6.05		.238
L1	5.46	5.72	.215	.225
q	44.32	44.58	1.745	1.755
q1	29.08	29.34	1.145	1.155
q2	44.32	44.58	1.745	1.755
q3	6.1	6.6	.24	.26
q4	7.49	7.75	.295	.305
q5	9.40	9.65	.370	.380
S	6.22	6.48	.245	.255
∅b	0.89	1.14	.035	.045
∅p	3.43	3.68	.135	.145

NOTES:
1. The U.S. government 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.
2. Lead identification for reference only.
3. Case outline weight: 92 grams maximum.

FIGURE 1. Case outline(s) - Continued.

Case Z

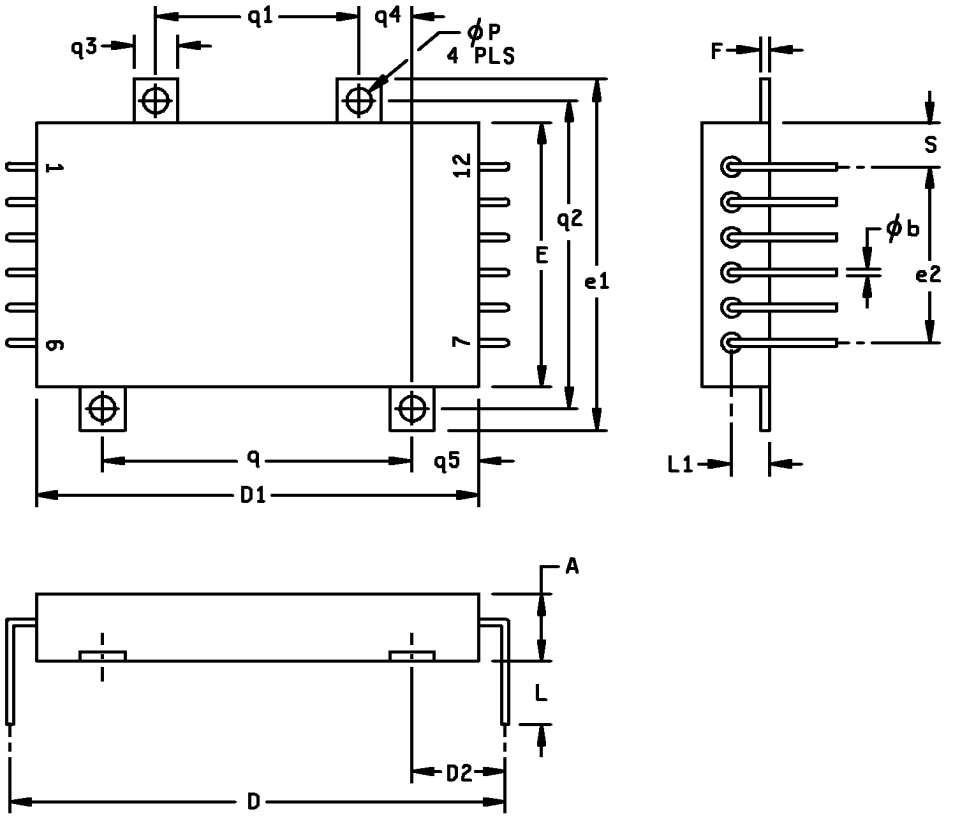

FIGURE 1. Case outline(s) - Continued.

STANDARD MICROCIRCUIT DRAWING DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43216-5000	SIZE A		5962-94722
		REVISION LEVEL	SHEET 14

DSCC FORM 2234
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Symbol	Millimeters		Inches	
	Min	Max	Min	Max
A		9.65		.380
D	71.00	71.25	2.795	2.805
D1	63.37	63.63	2.495	2.505
D2	13.21	13.46	.520	.530
E	37.97	38.23	1.495	1.505
e1	50.6	51.1	1.99	2.01
e2	25.27	25.53	.995	1.005
F	1.14	1.40	.045	.055
L	8.9	9.4	.35	.37
L1	5.46	5.72	.215	.225
q	44.32	44.58	1.745	1.755
q1	29.08	29.34	1.145	1.155
q2	44.32	44.58	1.745	1.755
q3	6.1	6.6	.24	.26
q4	7.49	7.75	.295	.305
q5	9.40	9.65	.370	.380
S	6.22	6.48	.245	.255
∅b	0.89	1.14	.035	.045
∅p	3.43	3.68	.135	.145

NOTES:
1. The U.S. government 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.
2. Lead identification for reference only.
3. Case outline weight: 92 grams maximum.

FIGURE 1. Case outline(s) - Continued.

Device type	01
Case outlines	U,X,Y,Z
Terminal number	Terminal symbol
1	Positive Input
2	Input Return
3	Case
4	Enable 1
5	Sync Output
6	Sync Input
7	Positive Output
8	Output Return
9	Return Sense
10	Positive Sense
11	Share
12	Enable 2

FIGURE 2. Terminal connections.

TABLE II. Electrical test requirements.

MIL-PRF-38534 test requirements	Subgroups (in accordance with MIL-PRF-38534, group A test table)
Interim electrical parameters	---
Final electrical 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 standard microcircuit drawing, the subgroups shall be defined.

4.2 Screening. Screening shall be in accordance with MIL-PRF-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 DSCC-VA 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.

4.3 Conformance and periodic inspections. Conformance inspection (CI) and periodic inspection (PI) shall be in accordance with MIL-PRF-38534 and as specified herein.

4.3.1 Group A inspection (CI). Group A inspection shall be in accordance with MIL-PRF-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 (PI). Group B inspection shall be in accordance with MIL-PRF-38534.

4.3.3 Group C inspection (PI). Group C inspection shall be in accordance with MIL-PRF-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 DSCC-VA 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 (PI). Group D inspection shall be in accordance with MIL-PRF-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 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 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. The devices shall be subjected to radiation hardness assured tests as specified in MIL-PRF-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-PRF-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 Supply Center Columbus when a system application requires configuration control and the applicable SMD. DSCC 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 DSCC-VA, telephone (614) 692-0526.

6.5 Comments. Comments on this drawing should be directed to DSCC-VA, Columbus, Ohio 43216-5000, or telephone (614) 692-0512.

6.6 Sources of supply. Sources of supply are listed in QML-38534. The vendors listed in QML-38534 have submitted a certificate of compliance (see 3.7 herein) to DSCC-VA and have agreed to this drawing.

STANDARD MICROCIRCUIT DRAWING BULLETIN

DATE: 98-12-03

Approved sources of supply for SMD 5962-94722 are listed below for immediate acquisition information only and shall be added to QML-38534 during the next revision. QML-38534 will be revised to include the addition or deletion of sources. The vendors listed below have agreed to this drawing and a certificate of compliance has been submitted to and accepted by DSCC-VA. This bulletin is superseded by the next dated revision of QML-38534.

Standard microcircuit drawing PIN 1/	Vendor CAGE number	Vendor Similar PIN 2/
5962-9472201HUA	52467	AFL2812SW/CH
5962-9472201HUC	52467	AFL2812SW/CH
5962-9472201HXA	52467	AFL2812SX/CH
5962-9472201HXC	52467	AFL2812SX/CH
5962-9472201HYA	52467	AFL2812SY/CH
5962-9472201HYC	52467	AFL2812SY/CH
5962-9472201HZA	52467	AFL2812SZ/CH
5962-9472201HZC	52467	AFL2812SZ/CH

1/ The lead finish shown for each PIN representing hermetic package is the most readily available from the manufacturer listed for that part. If the desired lead finish is not listed contact the vendor to determine its availability.

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

Vendor CAGE number	Vendor name and address
52467	Lambda Advanced Analog Incorporated 2270 Martin Avenue Santa Clara, CA 95050-2781

The information contained herein is disseminated for convenience only and the Government assumes no liability whatsoever for any inaccuracies in the information bulletin.