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

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	SHEET	1	2	3	4	5	6	7	8	9	10	11	12		

PMIC N/A

STANDARD MICROCIRCUIT 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
95-07-21

REVISION LEVEL

DEFENSE ELECTRONICS SUPPLY CENTER
DAYTON, OHIO 45444

MICROCIRCUIT, LINEAR, 12 VOLT, SINGLE CHANNEL, DC/DC CONVERTER, HYBRID

SIZE	CAGE CODE	5962-95562
A	67268	

SHEET 1 OF 12

DESC FORM 193
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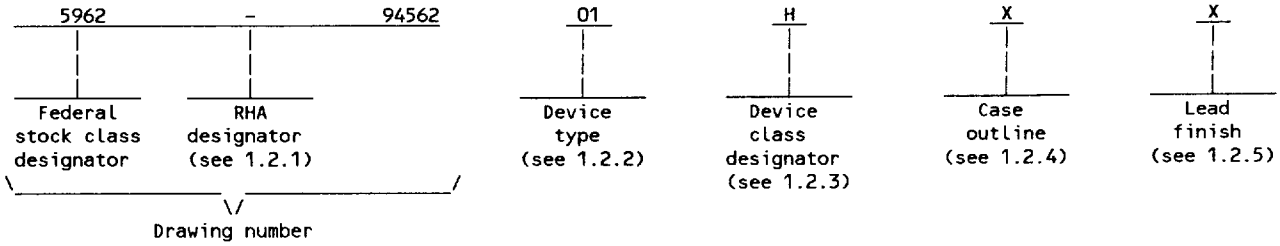
5962-E069-95

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

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
01	MHP27028S	DC-DC Converter, 65 W, 28 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 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 MIL-STD-1835 and as follows:

Outline letter	Descriptive designator	Terminals	Package style
X	See figure 1	12	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.

1.3 Absolute maximum ratings. 1/

Input voltage range 2/	-.5 V dc to +450 V dc
Power dissipation (P_D)	18 W
Lead soldering temperature (10 seconds)	+300°C
Storage temperature range	-65°C to +150°C

1.4 Recommended operating conditions.

Input voltage range	+160 V dc to +400 V dc
Output power	≤ 50 W
Case operating temperature range	-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/ An undervoltage lockout circuit shuts the unit off when the input voltage drops to approximately 120 volts. Operation of the unit between 120 volts and 160 volts is non-destructive at reduced output power, but performance is not guaranteed.

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.

3.3 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.

TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions $-55°C \le T_C \le +125°C$ V_{IN} = 270 V dc ± 1 V dc no external sync unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Output voltage	V_{OUT}	I_{OUT} = 2.32 A	1	01	27.72	28.28	V
			2,3		27.30	28.70	
Output current	I_{OUT}	V_{IN} = 160 V dc to 400 V dc	1,2,3	01	0.0	2.32	A
Output ripple voltage	V_{RIP}	I_{OUT} = 2.32 A, BW = 10 kHz to 2 MHz	1	01		100	mV p-p
			2,3			200	
Line regulation	VR_{LINE}	I_{OUT} = 2.32 A, V_{IN} = 160 V dc to 400 V dc	1,2,3	01		100	mV
Load regulation	VR_{LOAD}	I_{OUT} = 0 to 2.32 A	1,2,3	01		100	mV
Input current	I_{IN}	I_{OUT} = 0 A, inhibit (pins 3 and 4) open	1,2,3	01		20	mA
		I_{OUT} = 0 A, inhibit 1 (pin 4) tied to input return (pin 2)				10	
		I_{OUT} = 0 A, inhibit 2 (pin 3) tied to output return (pin 8)				15	
Input ripple current	I_{RIP}	I_{OUT} = 2.32 A, BW = 10 kHz to 10 MHz	1	01		45	mA p-p
			2,3			50	
Efficiency	Eff	I_{OUT} = 2.32 A	1	01	82		%
			2,3		81		
Switching frequency	Fs	I_{OUT} = 2.32 A	4,5,6	01	525	675	kHz
Short circuit current	I_{SC}	V_{OUT} < 1.0 V dc	1,2,3	01		5	A
Internal power dissipation short circuit	P_D	Pin - Pout	1	01		14	W
			2,3			15	
Load fault recovery 1/	Tr_{LF}	I_{OUT} = 2.32 A	4,5,6	01		20	ms

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} = 270 V dc ± 1 V dc, no external sync unless otherwise specified	Group A subgroups	Device type	Limits Min	Limits Max	Unit
Turn-on delay time	Ton_D	I_{OUT} = 2.32 A, V_{IN} = 0 V dc to 270 V dc	4,5,6	01		20	ms
Turn-on overshoot 1/	$Vton_{OS}$	I_{OUT} = 2.32 A, V_{IN} = 0 V dc to 270 V dc	4	01		280	mV pk
Output response to step transient load changes 2/	VT_{LOAD}	I_{OUT} = 1.16 A to 2.32 A	4,5,6	01		1800	mV pk
		I_{OUT} = 2.32 A to 1.16 A				1800	
Recovery time step transient load changes 1/ 2/ 3/	TT_{LOAD}	I_{OUT} = 1.16 A to 2.32 A	4,5,6	01		2.0	ms
		I_{OUT} = 2.32 A to 1.16 A				2.0	
Output response to transient step line changes 1/ 4/	VT_{LINE}	I_{OUT} = 2.32 A, V_{IN} = 160 V dc to 400 V dc	4,5,6	01		500	mV pk
		I_{OUT} = 2.32 A, V_{IN} = 400 V dc to 160 V dc				500	
Recovery time, transient step line changes 1/ 3/ 4/	TT_{LINE}	I_{OUT} = 2.32 A, V_{IN} = 160 V dc to 400 V dc	4,5,6	01		100	µs
		I_{OUT} = 2.32 A, V_{IN} = 400 V dc to 160 V dc				100	
Isolation	ISO	500 V dc, input to output	1	01	100		M Ω
		input to case			100		
		output to case			100		
Sync. range 5/	SYNC	I_{OUT} = 2.32 A	4,5,6	01	525	675	kHz
Capacitive load 1/ 6/	C_L	No effect on dc performance	1	01		500	µF

See footnotes on next page

TABLE I. Electrical performance characteristics - Continued.

1/ Parameter shall be tested as part of design characterization and after design or process changes; therefore, the Parameter shall be guaranteed to limits specified in table I.

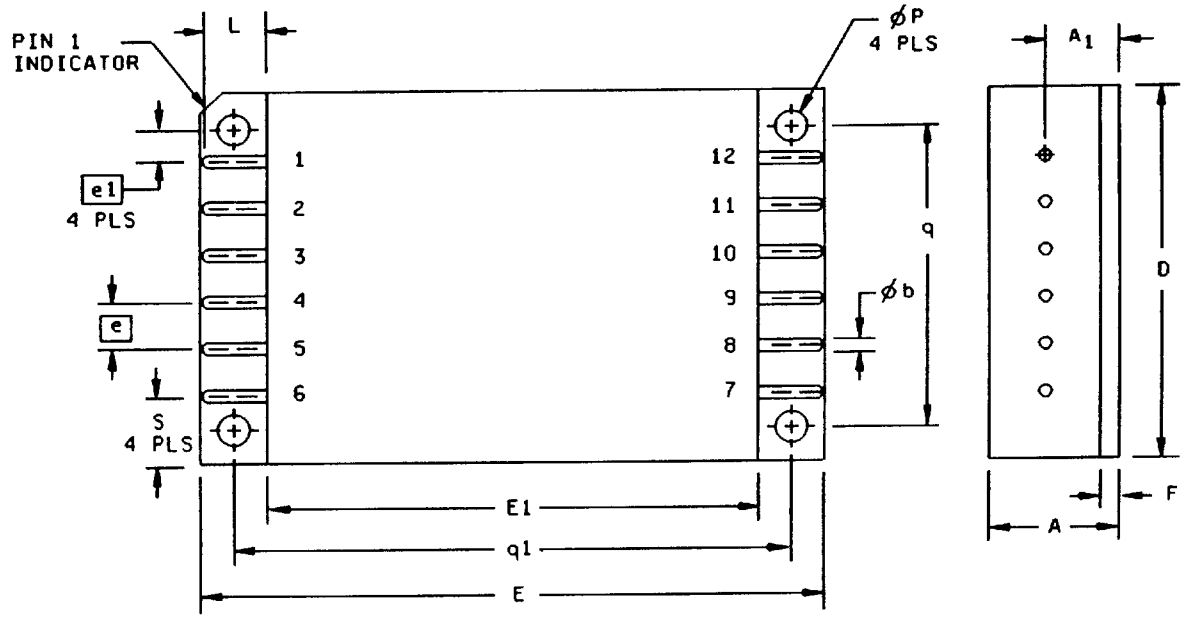
2/ Load step transition time between 2 and 10 microseconds.

3/ Recovery time is measured from the initiation of the transient until V_{OUT} has returned to within ±1 percent of its final value.

4/ Transition time greater than 10 microseconds.

5/ A TTL level waveform (V_{IH} = 4.5 V minimum, V_{IL} = 0.8 V maximum) with a 50 percent ±10 percent duty cycle applied to the sync input pin (pin 6) within the the sync range frequency shall cause the converter's switching frequency to become synchronous with the frequency applied to the sync input pin (pin 6).

6/ Capacitive load may be any value from 0 to the maximum limit without compromising dc performance.



Symbol	Millimeters		Inches	
	Min	Max	Min	Max
A		10.16		.400
A1	5.44	5.74	.214	.226
Øb	.89	1.14	.035	.045
D	37.97	38.23	1.495	1.505
e	5.08 BSC		.200 BSC	
e1	3.30 BSC		.130 BSC	
E	75.95	76.46	2.990	3.010
E1	63.37	63.63	2.495	2.505
F	1.14	1.40	.045	.055
L	5.58	6.09	.220	.240
ØP	3.12	3.38	.123	.133
q	31.88	32.13	1.255	1.265
q1	69.97	70.23	2.755	2.765
S	6.20	6.50	.244	.256

NOTES:
1. The case outline X was originally designed using inch-pound units of measurement, in the event of conflict between the metric and inch-pound units, the inch-pound shall take precedence.
2. Device weight: 86 grams maximum.

FIGURE 1. Case outline.

Device type	01
Case outline	X
Terminal number	Terminal symbol
1	Input
2	Input return
3	Inhibit 2
4	Inhibit 1
5	Sync output
6	Sync input
7	Positive output
8	Output return
9	Remote sense return
10	Positive remote sense
11	No connection
12	Share

NOTES:

1. Multiple devices may be used in parallel to drive a common load. When using this mode of operation the load current is shared up to five devices. In the current sharing mode, the share pin (pin 12) of all devices are connected together.

2. The device has a sync input pin (pin 6) and a sync output pin (pin 5) which allows multiple devices, whether their in a single unit or master/slave configurations to be synchronized to a system clock or each other. Two or more devices may be synchronized to each other by connecting the sync output pin (pin 5) of one to the sync input pin (pin 6) of another.

3. The device has two inhibit options, one is ground referenced to the input common and the other is referenced to the output common. The output referred inhibit pin uses the inhibit 2 pin (pin 3) a TTL compatiable open collector low will inhibit the device when applied to this pin.

FIGURE 2. Terminal connections.

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
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_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-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.

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.

Military documentation format	Example PIN under new system	Manufacturing source listing	Document listing
New MIL-H-38534 Standardized Microcircuit Drawings	5962-XXXXXZZ(H or K)YY	QML-38534	MIL-BUL-103
New MIL-I-38535 Standardized Microcircuit Drawings	5962-XXXXXZZ(Q or V)YY	QML-38535	MIL-BUL-103
New 1.2.1 of MIL-STD-883 Standardized Microcircuit 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.