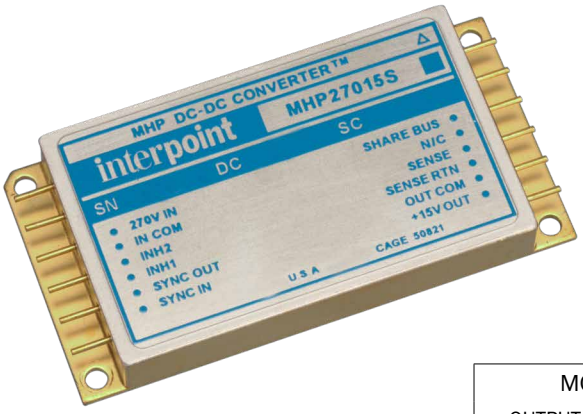
MHP270 Single and Dual DC-DC Converters

160 TO 400 VOLT INPUT — 50 TO 65 WATT

FEATURES

- Parallel operation with current share, up to 5 units (up to 276 watts)
- Operating range -55° to +100°C
- Input voltage 160 to 400 volts
- Transient protection 450 volt for 50 ms
- Fully isolated, magnetic feedback
- Fixed high frequency switching
- Remote sense on single models
- Inhibit primary side and secondary side
- Sync In and Sync Out
- Indefinite short circuit protection
- High power density, up to 85% efficiency, typical
- Soft-start function limits inrush current during start-up



MODELS OUTPUT VOLTAGE (V)	
SINGLE	DUAL
5	±5
12	±12
15	±15
28	

DESCRIPTION

The Interpoint® MHP270 Series™ DC-DC converters provide up to 65 watts of output power over -55°C to +100°C temperature range. The low profile MHP converters are manufactured in our fully certified and qualified MIL-PRF-38534 Class H production facility and packaged in hermetically sealed steel cases. Thick-film hybrid techniques provide military/aerospace reliability levels and optimum miniaturization. The MHP270 is packaged in a hermetically sealed case and operate from a MIL-STD-704 nominal 270-volt dc power bus. 160 to 400 volt continuous operation with surges to 450 volts for up to 50 milliseconds. Isolated outputs include 5, 12, 15, and 28 volt singles and ±5, ±12 and ±15 volt duals. Parallel operation for all loading conditions is supported without any requirement for external components. The converters are available with standard screening or "ES" screening. See Table 8 on page 10.

MHP270 DC-DC converters are constant frequency, pulse width modulated switching power supplies which use a quasi-square wave, two-switch single-ended forward converter design. Tight load regulation is achieved through a wide-bandwidth magnetic feedback circuit.

Up to five single output MHP270 converters may be used in parallel to power a single load by simply connecting the share pins of all units. Units in this configuration have an 85% current sharing accuracy over 35% load to full load conditions.

MHP270 Series of converters feature a flexible synchronization scheme in which units may be synchronized to an external clock or to one another by using Sync In and Sync Out pins provided on each unit. MHP270 converters have a nominal switching frequency of 525 kHz, but may be synchronized at any frequency from 475 to 575 kHz.

MHP270 converters meet a wide variety of military/aerospace performance and environmental specifications. Their continuous operation input voltage (160 to 400) meets the normal operating limits of MIL-STD-704. The unit shuts down above approximately 425 volts, but it is rated to withstand a surge of up to 450 volts for 50 milliseconds. The units are built as fully hermetic thick film hybrids in our MIL-PRF-38534 certified facilities.

FEATURES

Undervoltage lock-out – shuts down when the input line voltage falls below approximately 120 volts to provide smooth initialization.

Continuous short circuit protection – current limit set at approximately 125%.

Soft-start – controlled start-up at turn-on, release from inhibit and recovery from load fault conditions.

Remote sense – Sense lines increase the output voltage to compensate for IR drops in traces and wires. The voltage compensation can be up to a maximum of 10% of nominal output voltage to maintain tightly regulated voltage at the load.

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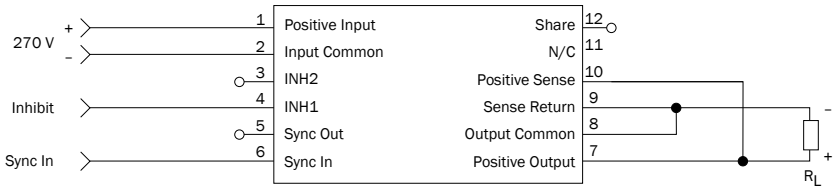
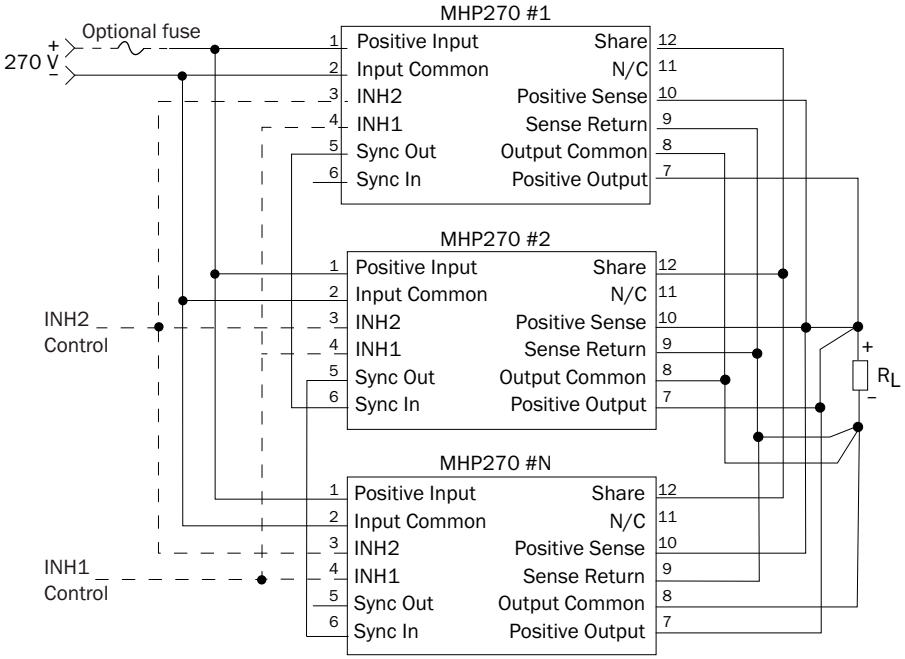


FIGURE 1: SENSE CONNECTIONS SINGLE OUTPUT MODELS



- Dotted lines are optional connections
- Sync in should be connected to input common if not used
- Synchronizing the converters eliminates beat frequencies during current sharing (parallel operation)
- From 2 to 5 converters can be paralleled for up to 276 watts of output power.
- These converters are not designed for use in redundant systems
- If deviating from this diagram, please consult our Applications Engineers at powerapps@craneae.com.

FIGURE 2: CURRENT SHARING CONNECTIONS (PARALLEL OPERATION) SINGLE OUTPUT MODELS

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PIN OUT		
Pin	Single Output	Dual Output
1	Positive Input	Positive Input
2	Input Common	Input Common
3	Inhibit 2 (INH2)	Inhibit 2 (INH2)
4	Inhibit 1 (INH1)	Inhibit 1 (INH1)
5	Sync Out	Sync Out
6	Sync In	Sync In
7	Positive Output	Positive Output
8	Output Common	Output Common
9	Sense Return	Negative Output
10	Positive Sense	No connection
11	No connection	No connection
12	Share	Share

TABLE 1: PIN OUT

PINS NOT IN USE	
Inhibit (INH1, INH2)	Leave unconnected
Sync Out	Leave unconnected
Sync In	Connect to input common
Share	Leave unconnected
Sense Lines	Must be connected to appropriate outputs

TABLE 2: PINS NOT IN USE

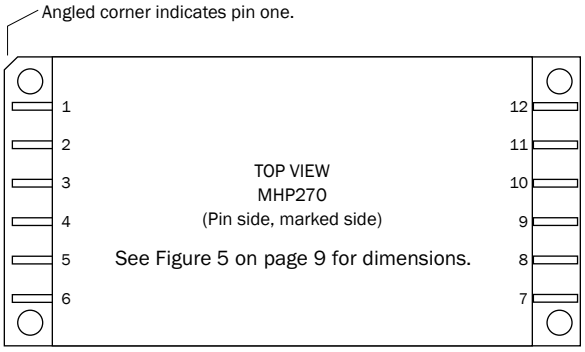

FIGURE 3: PIN OUT

MHP270 Single and Dual DC-DC Converters

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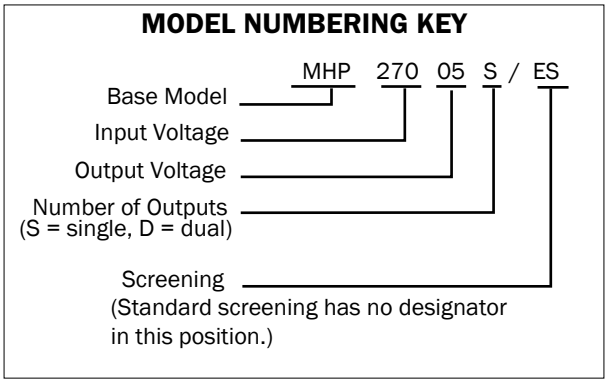

FIGURE 4: MODEL NUMBERING KEY

MODEL NUMBER OPTIONS

TO DETERMINE THE MODEL NUMBER ENTER ONE OPTION FROM EACH CATEGORY IN THE FORM BELOW.

CATEGORY	Base Model and Input Voltage	Output Voltage	Number of Outputs [1]	Screening [2]
OPTIONS	MHP270	05, 12, 15, 28	S	(standard, leave blank)
		05, 12, 15	D	ES
FILL IN FOR MODEL # [3]	MHP270	_____	_____	/ _____

Notes
1. Number of Outputs: S is a single output and D is a dual output.
2. Screening: For standard screening leave the screening option blank. For other screening options, insert the desired screening level. For more information see Table 8 on page 10.
3. If ordering by model number add a "-Q" to request solder dipped leads (MHP27005S/ES-Q).

TABLE 3: MODEL NUMBER OPTIONS

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TABLE 4: OPERATING CONDITIONS, ALL MODELS, 25°C CASE, 270 VIN, 100% LOAD, UNLESS OTHERWISE SPECIFIED.

		ALL MODELS			
PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
LEAD SOLDERING TEMPERATURE [1]	10 SECONDS MAX.	—	—	300	°C
STORAGE TEMPERATURE [1]		-65	—	+150	°C
CASE OPERATING TEMPERATURE	FULL POWER	-55	—	+100	°C
ISOLATION: INPUT TO OUTPUT, INPUT TO CASE, OUTPUT TO CASE [2]	@ 500 VDC AT 25°C	100	—	—	Megohms
INPUT TO OUTPUT CAPACITANCE [1]		—	150	—	pF
UNDERVOLTAGE LOCKOUT [1]	-55°C TO +100°C	110	—	—	V
CURRENT LIMIT [3]	% OF FULL LOAD	—	125	—	%
SWITCHING FREQUENCY	-55°C TO +100°C	475	525	575	kHz
SYNCHRONIZATION IN -55°C TO +100°C	INPUT FREQUENCY	475	—	575	kHz
	DUTY CYCLE [1]	40	—	60	%
	ACTIVE LOW	—	—	0.8	V
	ACTIVE HIGH [1]	4.5	—	10.0	
	REFERENCED TO	INPUT COMMON			
	IF NOT USED	CONNECT TO INPUT COMMON			
SYNCHRONIZATION OUT	REFERENCED TO	INPUT COMMON			
	IF NOT USED	LEAVE UNCONNECTED			
INHIBIT 1 ACTIVE LOW (OUTPUT DISABLED) Do not apply a voltage to the inhibit pin. [4]	INHIBIT PIN PULLED LOW	—	—	0.8	V
	INHIBIT PIN SOURCE CURRENT [1]	—	—	15	mA
	REFERENCED TO	INPUT COMMON			
INHIBIT 1 ACTIVE HIGH (OUTPUT ENABLED) Do not apply a voltage to the inhibit pin. [4]	INHIBIT PIN CONDITION	OPEN COLLECTOR OR UNCONNECTED			
	OPEN INHIBIT PIN VOLTAGE [1]	—	—	12	V
INHIBIT 2 ACTIVE LOW (OUTPUT DISABLED) Do not apply a voltage to the inhibit pin. [4]	INHIBIT PIN PULLED LOW	—	—	0.2	V
	INHIBIT PIN SOURCE CURRENT [1]	—	—	15	mA
	REFERENCED TO	OUTPUT COMMON			
INHIBIT 2 ACTIVE HIGH (OUTPUT ENABLED) Do not apply a voltage to the inhibit pin. [4]	INHIBIT PIN CONDITION	OPEN COLLECTOR OR UNCONNECTED			
	OPEN INHIBIT PIN VOLTAGE [1]	—	—	5	V

Notes
1. Guaranteed by characterization test and/or analysis. Not a production test.
2. When testing isolation, input pins are tied together and output pins are tied together. They are tested against each other and against case. Discharge the pins before and after testing.
3. Dual outputs: The over-current limit will trigger when the sum of the currents from both outputs reaches 125% (typical value) of the maximum rated "total" current of both outputs.
4. An external inhibit interface should be used to pull the inhibits low or leave them floating. The inhibit pins can be left unconnected if not used. In Share mode, for Inhibit 1, use common inhibit signal for all converters

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TABLE 5: ELECTRICAL CHARACTERISTICS 25°C CASE, 270 VIN, 100% LOAD, UNLESS OTHERWISE SPECIFIED.

SINGLE OUTPUT MODELS		MHP27005S			MHP27012S			UNITS
PARAMETER	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	
OUTPUT VOLTAGE		4.95	5.00	5.05	11.88	12.00	12.12	V
OUTPUT CURRENT	V_{IN} = 160 TO 400	0	—	10	0	—	5.0	A
OUTPUT POWER	V_{IN} = 160 TO 400	0	—	50	0	—	65	W
OUTPUT RIPPLE	10 kHz - 2 MHz	—	—	50	—	—	80	mV p-p
LINE REGULATION [2]	V_{IN} = 160 TO 400	—	—	50	—	—	120	mV
LOAD REGULATION [2]	NO LOAD TO FULL	—	—	50	—	—	120 0	mV
INPUT VOLTAGE	CONTINUOUS	160	270	400	160	270	400	V
	TRANSIENT 50 msec. [1, 3]	—	—	450	—	—	450	
INPUT CURRENT	NO LOAD	—	—	20	—	—	20	mA
	INHIBITED–INH1	—	—	8	—	—	8	
	INHIBITED–INH2	—	—	15	—	—	15	
INPUT RIPPLE CURRENT	10 kHz - 10 MHz	—	—	60	—	—	70	mA p-p
EFFICIENCY		76	—	—	80	—	—	%
LOAD FAULT SHORT CIRCUIT	POWER DISSIPATION	—	—	30	—	—	45	W
STEP LOAD RESPONSE [4, 5]	TRANSIENT	—	—	±300	—	—	±1800	mV pk
50% - 100% - 50%	RECOVERY	—	—	300	—	—	1000	µs
CAPACITIVE LOAD [1, 6]		—	—	1000	—	—	500	µF

Notes
1. Guaranteed by characterization test and/or analysis. Not a production test.
2. Load and line transition time > 10 µs
3. Unit will shut down above approximately 425 volts but will be undamaged and will restart when voltage drops into normal range.
4. Step load test is performed at 10 microseconds typical.
5. Recovery time is measured from application of the transient to point the point at which Vout is within 1% of final value.
6. No affect on dc performance.

MHP270 Single and Dual DC-DC Converters

160 TO 400 VOLT INPUT — 50 TO 65 WATT

TABLE 6: ELECTRICAL CHARACTERISTICS 25°C CASE, 270 VIN, 100% LOAD, UNLESS OTHERWISE SPECIFIED.

SINGLE OUTPUT MODELS		MHP27015S			MHP27028S			UNITS
PARAMETER	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	
OUTPUT VOLTAGE		14.85	15.00	15.15	27.72	28.00	28.28	V
OUTPUT CURRENT	V_{IN} = 160 TO 400	0	—	4.33	0	—	2.32	A
OUTPUT POWER	V_{IN} = 160 TO 400	0	—	65	0	—	65	W
OUTPUT RIPPLE	10 kHz - 2 MHz, 25°C	—	—	90	—	—	280	mV p-p
LINE REGULATION [2]	V_{IN} = 160 TO 400	—	—	150	—	—	280	mV
LOAD REGULATION [2]	NO LOAD TO FULL	—	—	150	—	—	280	mV
INPUT VOLTAGE	CONTINUOUS	160	270	400	160	270	400	V
	TRANSIENT 50 msec. [1, 3]	—	—	450	—	—	450	
INPUT CURRENT	NO LOAD	—	—	20	—	—	20	mA
	INHIBITED–INH1	—	—	7	—	—	8	
	INHIBITED–INH2	—	—	15	—	—	15	
INPUT RIPPLE CURRENT	10 kHz - 10 MHz	—	—	65	—	—	70	mA p-p
EFFICIENCY		80	—	—	80	—	—	%
LOAD FAULT SHORT CIRCUIT	POWER DISSIPATION	—	—	45	—	—	45	W
STEP LOAD RESPONSE [4, 5]	TRANSIENT	—	—	±750	—	—	±1800	mV pk
50% - 100% - 50%	RECOVERY	—	—	300	—	—	1000	µs
CAPACITIVE LOAD [1, 6]		—	—	500	—	—	500	µF

Notes
1. Guaranteed by characterization test and/or analysis. Not a production test.
2. Load and line transition time > 10 µs
3. Unit will shut down above approximately 425 volts but will be undamaged and will restart when voltage drops into normal range.
4. Step load test is performed at 10 microseconds typical.
5. Recovery time is measured from application of the transient to point the point at which Vout is within 1% of final value.
6. No affect on dc performance.

MHP270 Single and Dual DC-DC Converters

160 TO 400 VOLT INPUT — 50 TO 65 WATT

TABLE 7: ELECTRICAL CHARACTERISTICS 25°C CASE, 270 VIN, 100% LOAD, UNLESS OTHERWISE SPECIFIED.

DUAL OUTPUT MODELS [2]		MHP27005D			MHP27012D			MHP27015D			UNITS
PARAMETER	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
OUTPUT VOLTAGE	+ V_{OUT}	4.95	5.00	5.05	11.88	12.00	12.12	14.85	15.00	15.15	V
	- V_{OUT}	4.92	5.00	5.08	11.82	12.00	12.18	14.77	15.00	15.23	
OUTPUT CURRENT [3]	EITHER OUTPUT	—	±5	8.0 [1]	—	±2.5	4.0 [1]	—	±2.17	3.46 [1]	A
V_{IN} = 160 TO 400	TOTAL OUTPUT	—	—	10	—	—	5	—	—	4.33	
OUTPUT POWER [3]	EITHER OUTPUT	—	—	40 [1]	—	—	48 [1]	—	—	52 [1]	W
V_{IN} = 160 TO 400	TOTAL OUTPUT	—	—	50	—	—	60	—	—	65	
OUTPUT RIPPLE	10 kHz - 2 MHz, 25°C	—	±50	±100	—	±50	±125	—	±50	±125	mV p-p
LINE REGULATION [4]	V_{IN} = 160 TO 400	—	—	±100	—	—	±120	—	—	±150	mV
LOAD REGULATION [4, 5]	NO LOAD TO FULL	—	—	±100	—	—	±120	—	—	±150	mV
CROSS REGULATION [6]	EFFECT ON –VOUT	—	—	1000	—	—	800	—	—	750	mV
INPUT VOLTAGE	CONTINUOUS	160	270	400	160	270	400	160	270	400	V
	TRANSIENT 50 ms [1, 7]	0	—	450	0	—	450	0	—	450	
INPUT CURRENT	NO LOAD	—	—	20	—	—	20	—	—	20	mA
	INHIBITED–INH1	—	—	8	—	—	8	—	—	8	
	INHIBITED–INH2	—	—	15	—	—	15	—	—	15	
INPUT RIPPLE CURRENT	10 kHz - 10 MHz	—	—	60	—	—	60	—	—	65	mA p-p
EFFICIENCY T_C = 25°C	BALANCED LOAD	74	—	—	81	_	—	82	_	—	%
LOAD FAULT SHORT CIRCUIT	POWER DISSIPATION	—	—	30	—	—	35	—	—	45	W
STEP LOAD RESPONSE [8, 9, 10]	TRANSIENT ±V_{OUT}	—	—	±300	—	—	±900	—	—	±900	mV pk
50%-100%-50%, BALANCED LOADS	RECOVERY	—	—	300	—	—	300	—	—	300	µs
CAPACITIVE LOAD [1, 11, 12]		—	—	—	—	—	500	—	—	500	µF

Notes
1. Guaranteed by characterization test and/or analysis. Not a production test.
2. Share operation not characterized for dual outputs.
3. Up to 80% of the total output power is available from either output provided that the opposite output is simultaneously carrying 20% of the total output power.
4. Load and line transition time >10 µs
5. Assumes balanced loads on the outputs.
6. Effect on the negative output from 50%/50% loads to 70%/30% or 30%/70% loads at 25°C,
7. Unit will shut down above approximately 425 volts but will be undamaged and will restart when voltage drops into normal range.
8. Recovery time is measured from application of the transient to point at which Vout is within 1% of final value.
9. Step load test is performed at 10 microseconds typical.
10. Second output at 50%
11. No affect on dc performance.
12. Applies each output.

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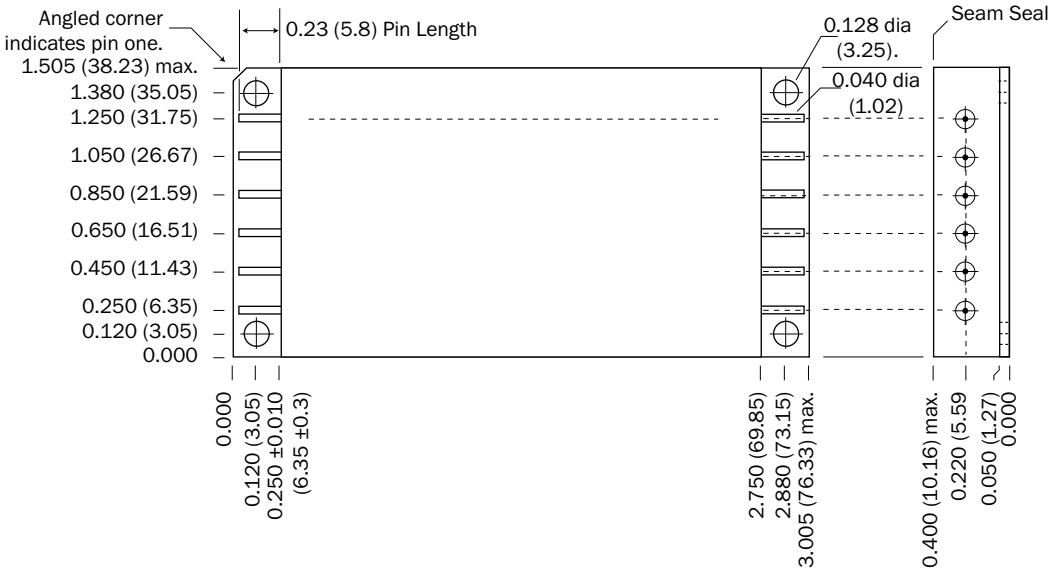
TOP VIEW CASE U
Flanged case, short leads

Case “U” does not require an option in the Case Option position of the model number.



Weight: 86 grams maximum

Case dimensions in inches (mm)
Tolerance ±0.005 (0.13) for three decimal places
±0.01 (0.3) for two decimal places
unless otherwise specified

CAUTION
Heat from reflow or wave soldering may damage the device. Solder pins individually with heat application not exceeding 300 °C for 10 seconds per pin.

Materials

Header	Cold Rolled Steel/Nickel/Gold
Cover	Kovar/Nickel
Pins	#52 alloy/Gold, compression glass seall Gold plating of 50 - 150 microinches is included in pin diameter Seal Hole: 0.120 ±0.002 (3.05 ±0.05)

Please refer to the numerical dimensions for accuracy.

FIGURE 5: CASE U

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ENVIRONMENTAL SCREENING STANDARD AND /ES [1]

TEST PERFORMED	STANDARD	/ES
Pre-cap Inspection Method 2017, 2032	■	■
Temperature Cycle (10 times) Method 1010, Cond. B, -55°C to +125°C, ambient		■
Constant Acceleration Method 2001, 500 g		■
Burn-in Method 1015 [2] 96 hours		■
Final Electrical Test MIL-PRF-38534, Group A Subgroups 1 and 4: +25°C case	■	■
Hermeticity Test, Method 1014		
Gross Leak, Cond. C_1, fluorocarbon		■
Fine Leak, Cond. A_2, helium		■
Gross Leak, Dip	■	
Final visual inspection Method 2009	■	■

Test methods are referenced to MIL-STD-883 as determined by MIL-PRF-38534.

Notes
1. Standard and /ES products may not meet all of the requirements of MIL-PRF-38534.
2. Burn-in temperature designed to bring the case temperature to the maximum case temperature of the product. Refer to the specific product information for the maximum case temperature. Burn-in is a powered test.

TABLE 8: ENVIRONMENTAL SCREENING DC-DC CONVERTERS AND EMI FILTERS STANDARD AND /ES