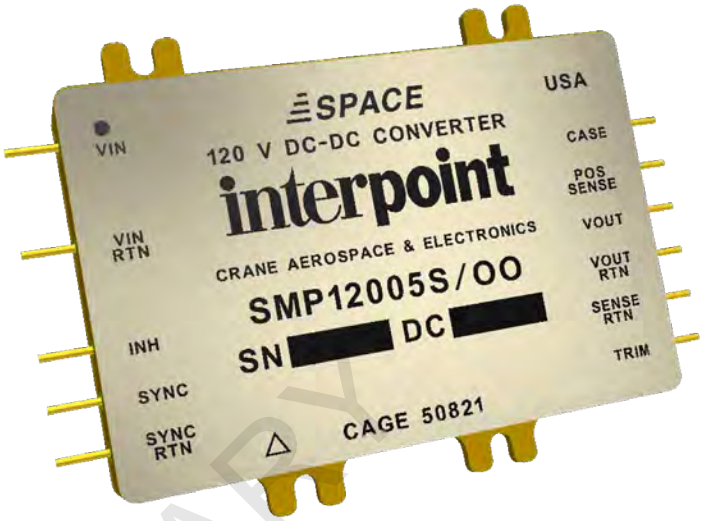
SMP120 Single Output Space DC-DC Converters

PRELIMINARY – 80 TO 160 VOLT INPUT – 49 WATT

FEATURES

- Radiation tolerant space converter [1]
  - Single event effects (SEE) LET performance to 43 MeV cm^2/mg
  - Total ionizing dose (TID) guaranteed per MIL-STD-883 method 1019, radiation hardness assurance (RHA) L = 50 krad(Si), R = 100 krad(Si)
  - 50 - 300 rad(Si)/sec dose rate (Condition A)
  - 10 mrad(Si)/sec dose rate (Condition D)
- Output overvoltage protection
- Inrush current limit
- Built in EMI filter
- Output trim from ±10% of nominal
- Operating temperature -55° to +125°C
- Screened to MIL-PRF-38534 Class H and K [1]
- Input voltage range 80-160 volts
- Transient protection 180 volts for 100 ms
- Fully isolated, magnetic feedback
- Fixed high frequency switching
- Remote sense
- Inhibit function, synchronization input
- Indefinite short circuit protection



MODELS OUTPUT VOLTAGE (V)
SINGLE
5
28

HIGH VOLTAGE WARNING

Care should be taken when the converter is in a live circuit.
There is the potential for up to 160 volts at the input power pins.

DESCRIPTION

The Interpoint® SMP120 Series™ of DC-DC converters offers up to 49 watts of power in a radiation tolerant design. The low profile SMP120 converters are manufactured in our fully certified and qualified MIL-PRF-38534 Class K production facility and packaged in hermetically sealed steel cases. They are ideal for use in programs requiring high reliability, small size, and high levels of radiation hardness assurance.

The SMP120 converters are switching regulators which use a current mode control single switch forward design with a nominal switching frequency of 500 kHz. Close regulation is maintained with advanced constant frequency pulse width modulation design techniques. The SMP120's current mode control topology provides high levels of input-to-output ripple rejection.

RADIATION TOLERANCE

The SMP120 DC-DC converters are designed to provide continuous normal operation through radiation levels associated with space missions and in tactical and strategic military environments. The RHA level converters will meet their SMD electrical characteristics up to the rated TID levels at both low dose rates (condition D method 1019 of MIL-STD-883) and high does rates (condition A of method 1019 of MIL-STD-883).

These levels of radiation tolerance make the SMP120 converters suitable to provide power to electronic systems in programs where operation in high radiation environments is required.

1. Screened to MIL-PRF-38534. Class H and K and RHA L and R are pending product validation.

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Screening

SMP120 converters offer screening options of space prototype (O), Class H or K and radiation hardness assurance (RHA) levels L 50 krad(Si) or R 100 krad(Si). The converters are screened to MIL-PRF-38534. Class H and K and RHA L and R are pending product validation.

Radiation performance,

- SEE LET performance 43 MeV cm^2/mg
- SEB (no burn-out) 43 MeV cm^2/mg
- SEL (no latch-up) 43 MeV cm^2/mg
- SET 43 MeV cm^2/mg

Undervoltage Lockout

The converters have an undervoltage lockout that will allow power conversion at approximately 75 volts on a rising input voltage and a conversion shut-down on a falling voltage at approximately 72 volts. During these conditions, output regulation may not meet nominal input voltage specifications.

The SMP120 converters have an undervoltage lockout (UVLO) circuit that will hold the converter off until the input voltage rises to approximately 75 volts at which point power conversion will begin. When the input voltage falls to approximately 72 volts, the converter will power off. When the input voltage is between 72 and 75 volts, the output voltage may not meet nominal voltage regulation specifications.

Output Overvoltage protection

The SMP120 overvoltage protection circuit comprises a redundant reference voltage and comparator to detect when the output voltage exceeds approximately 130% of the nominal output voltage. When an output overvoltage condition is detected, the protection circuit forces the converter to shutdown for a few milliseconds and initiate a restart. If the overvoltage condition persists, the protection circuit will repeat the shutdown/restart cycle until the overvoltage condition goes away or the converter is inhibited externally.

When using the trim function, the margin between the trimmed voltage and the overvoltage threshold will be reduced since the overvoltage threshold is fixed at 130% of the nominal output voltage.

Inrush Current Limiter

The SMP120 inrush current limiter comprises an N-Channel MOSFET as a simple timer. When the inhibit pin is released, a high voltage current source charges a capacitor that is connected between the gate and source of the current limiter FET. This causes the gate voltage to rise at a rate determined by the current and capacitor. When the gate voltage approaches the FET threshold voltage, the FET starts to conduct. Initially, the FET appears as a large resistance in series with the internal capacitance of the converter allowing the capacitance to charge slowly and limiting the inrush current at start up. As the gate voltage increases, the resistance of the current limiter FET decreases until the FET is fully on thereby minimizing the power loss due to the current limit circuit.

Sense on 5 Volt Single Output

Tight load regulation is maintained via a wide bandwidth magnetic feedback and through the use of remote sense on the 5 volt single output models. The sense pin function allows a remote connection for the voltage regulation circuit to compensate for voltage drops between the converter and the point of use. Up to 500 mV is allowed between the positive sense and the positive output and between the sense return and output return.

Note that if the sense pins are connected but the output voltage pins are not, the converter may be damaged.

CAUTION: The converter will be permanently damaged if the positive sense (pin 10) is shorted to ground. Damage may also result if the output common or positive output is disconnected from the load when the remote sense leads are connected to the load.

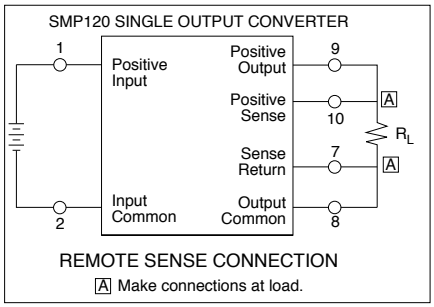

Figure 1: Remote Sense

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Inhibit

The SMP120 Series incorporates an inhibit terminal that can be used to disable internal switching. It is not recommended to tie the Inhibit pin of an SMP120 directly to the Inhibit pin of another converter as the SMP120 Inhibit pin can sink current.

When pulling multiple inhibit signals low, a separate interface is recommended for each SMP120. The converter is inhibited when the Inhibit pin is pulled low (<1.0 V). In the inhibit mode the inhibit pin current requirement is less than ~500 μA. The converter resumes normal operation when an open circuit is applied to the Inhibit pin or the Inhibit pin is released. The open circuit voltage of the Inhibit pin is 10 to 13.6 volts.

To enable the converter use an open collector on the Inhibit pin or leave it unconnected. See Figure 2.

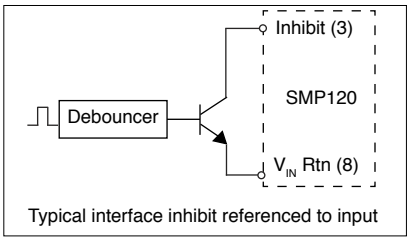

Figure 2: Inhibit Interface (Delay not added)

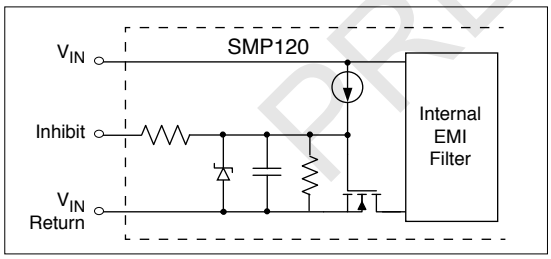

Figure 3: Inhibit

Operation

The SMP120 is a single-ended current mode control forward converter. Rectification is performed using Schottky diodes.

Effects of External Voltage Source and Remote Sense Connections

Care must be taken to avoid accidental disconnection of the Positive Output (Pin 10) or Output Common (Pin 8) when Remote Sense is used. If the sense pins are connected to the load, but the output power pins are not connected to the load, then the converter may be damaged. Also, care should be taken not to swap the sense pin connections as permanent damage to the unit will result.

Load Current Sharing

The SMP120 converters do not support load current sharing or parallel operation.

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SEQUENCING

The SMP120 converters are well suited for providing an intermediate bus voltage to power low voltage DC-DC converters and Point of Load (POL) converters. In order to ensure predictable start up and turn off behavior, proper sequencing of the SMP120 and associated load is highly recommended. The timing diagram, Figure 4, shows a typical sequence of the application/removal of power and enabling/inhibiting of the SMP120 and load.

Ideally, the SMP120 is enabled after the input power has stabilized. Once the SMP120 output voltage has stabilized, the POL may be enabled. During turn off, the sequence is reversed with one exception, the SMP120 and POL may be inhibited simultaneously, then the input power may be removed. Adhering to this sequencing protocol will ensure that the SMP120 and POL will power up and down in a predictable manner.

Table 1 below describes the timing in more detail.

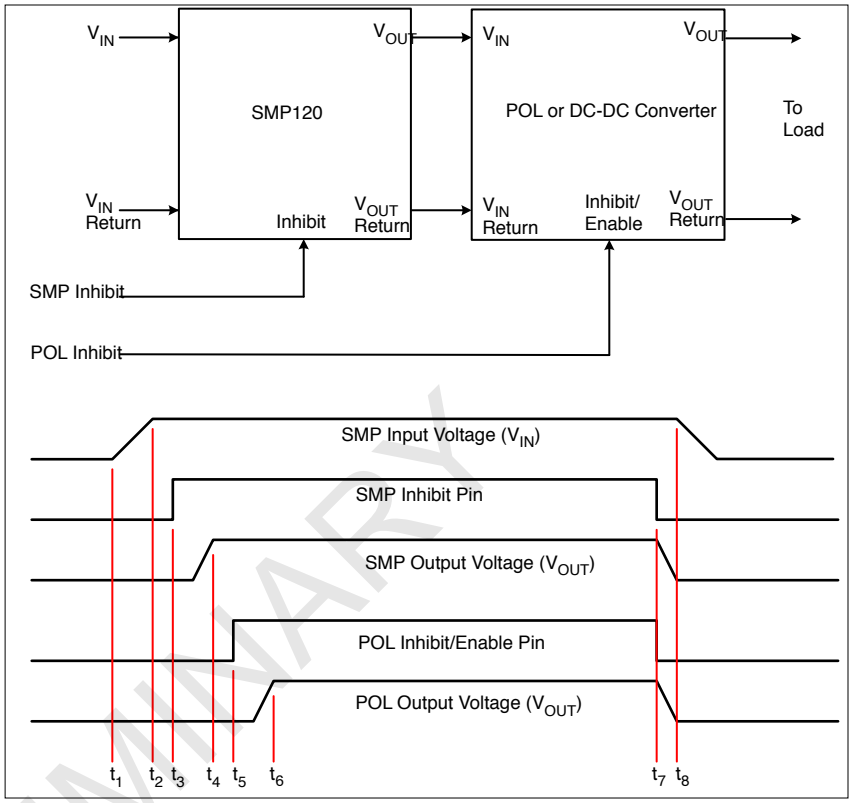

FIGURE 4: SEQUENCE DIAGRAM

Sequence	Description	Minimum Time
t1 – t2	Initial application of power	Dependent on system characteristics
t2 – t3	Input power stabilization	Dependent on system characteristics
t3	Enable SMP120	
t3 - t4	SMP120 Output Voltage start up	25 ms max
t4 – t5	SMP120 Output Voltage stabilization time	<1 ms
t5	Enable POL	
t5 – t6	POL Output Voltage start up	Dependent on POL
t6 – t7	Normal operation	
t7	Inhibit SMP120 and POL, may be simultaneous	
t7 – t8	SMP120 and POL output voltage turn off and decay	Dependent on load
t8	Removal of input power.	

TABLE 1: SEQUENCE TIMING

SMP120 Single Output Space DC-DC Converters

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Synchronization

The Sync Input pin is isolated which allows the Sync Return pin to be tied to the primary side, secondary side, or float with respect to all inputs and outputs.

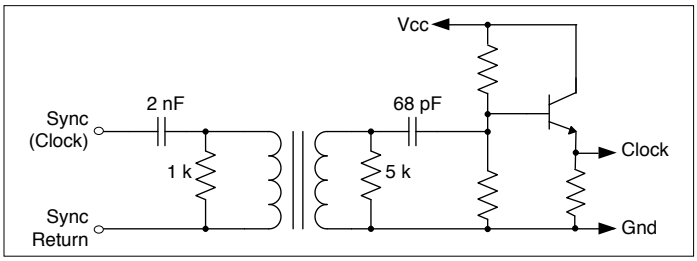

Figure 5: Sync

EMI

The SMP120 includes an integrated 2-section, damped LC EMI filter to reduce the reflected input current ripple. The filter is damped to reduce the peaking at resonance to minimize the stress on the EMI filter and power components. The damping also serves to minimize the interaction of the filter output impedance with the negative input impedance of the DC-DC converter.

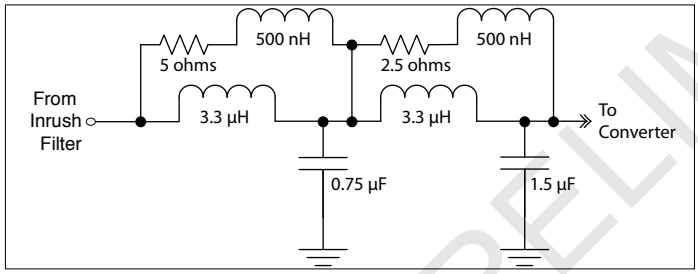

Figure 6: Built in EMI Filter

Electrostatic Discharge Sensitivity (ESD)

The SMP120 Series converters ESD rating is TBD.

Output Voltage Trim

The output voltage may be trimmed up or down approximately +/-10% by tying the Trim pin to ground or tied to V_{OUT} pin via a programming resistor (R_{TRIM}).

To trim up connect the trim resistor to V_{OUT} Return (pin 8). For the 5 volt singles, Sense Return (pin 7) must also be connected to V_{OUT} Return (pin 8).

To trim down connect the trim resistor to V_{OUT} (pin 9). For the 5 volt singles, Positive Sense (pin 10) must also be connected to V_{OUT} (pin 9).

R_T is the external trim resistor in kilo ohms.

X = V_{OUT} -2.5 (where V_{OUT} is the desired output voltage)

5 volt output trim
Trim up: R_T = (12.475/(X-2.5))-16.5.
Trim down; R_T = (4.99*X/(2.5-X))-16.5.

28 volt output trim
Trim up: R_T = (127.75/(X-25.6012))-33.2
Trim down: R_T = (51.1*X/(25.6012-X))- 33.2

NOTE: Do not exceed maximum output current rating when trimming down.

NOTE: Do not exceed maximum output power rating when trimming up.

SMP120 Single Output Space DC-DC Converters

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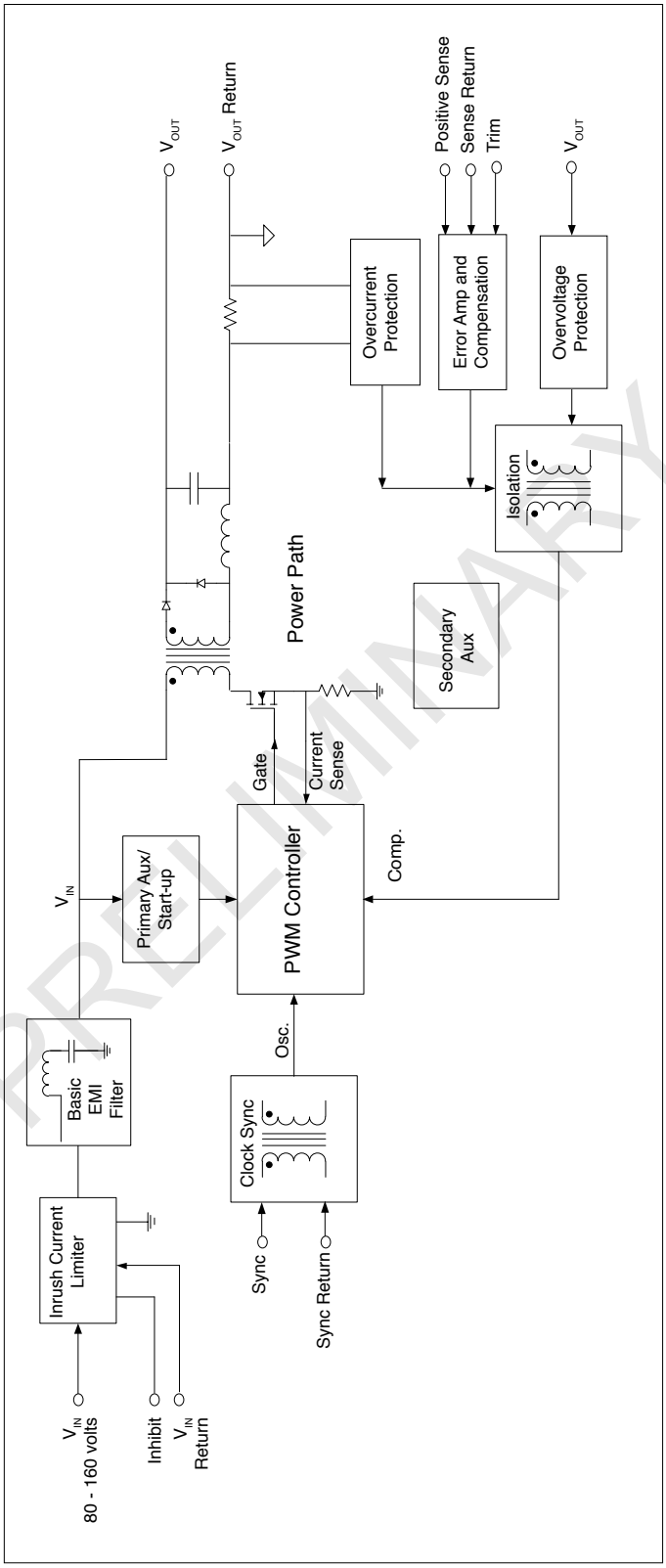

FIGURE 7: SMP120 BLOCK DIAGRAM 5 VOLT SINGLE

SMP120 Single Output Space DC-DC Converters

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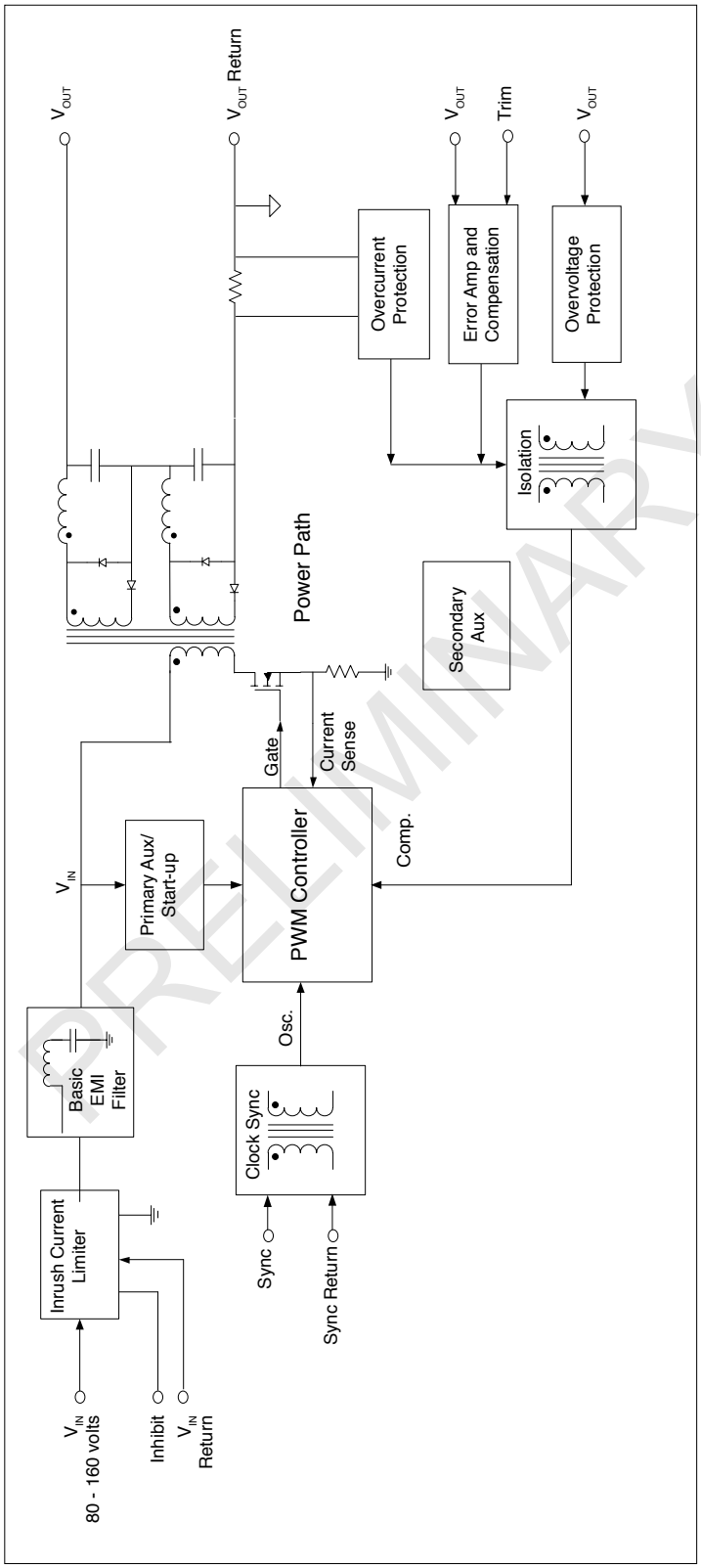

FIGURE 8: SMP120 BLOCK DIAGRAM 28 VOLT SINGLE

SMP120 Single Output Space DC-DC Converters

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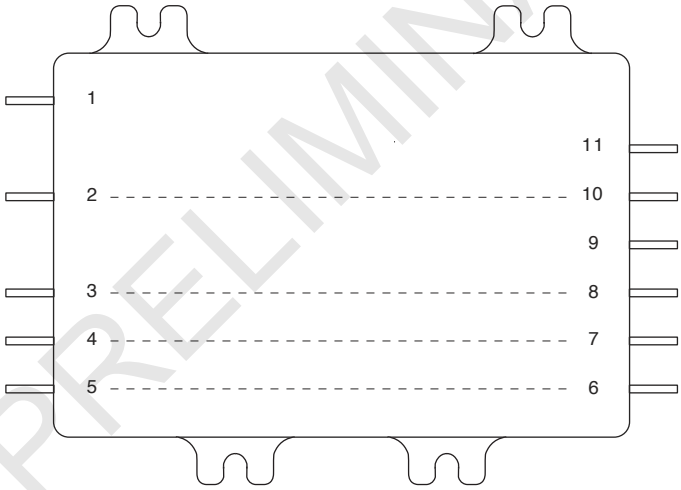
PIN OUT		
Pin	**5 Volt Single Output**	**28 Volt Single Output**
1	V_{IN}	V_{IN}
2	V_{IN} Return	V_{IN} Return
3	Inhibit	Inhibit
4	Sync (External Clock)	Sync (External Clock)
5	Sync Return	Sync Return
6	Trim	Trim
7	Sense Return	No Connection
8	V_{OUT} Return	V_{OUT} Return
9	V_{OUT}	V_{OUT}
10	Positive Sense	No Connection
11	Case	Case

TABLE 2: PIN OUT



For dimensions see Figure 12.

FIGURE 9: TOP VIEW PIN OUT

PINS NOT IN USE	
Inhibit	Leave unconnected
Sync In	Connect to Sync Return
Sense Lines	Must be connected to appropriate outputs
Trim	Leave unconnected
Case	Leave unconnected

FIGURE 10: PINS NOT IN USE

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MODEL NUMBERING KEY

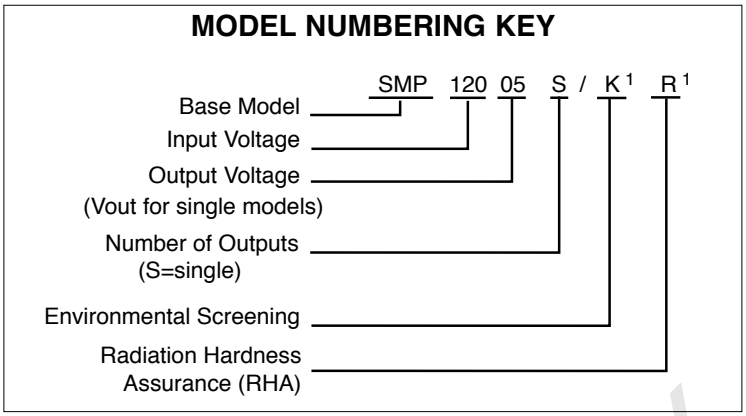

FIGURE 11: MODEL NUMBERING KEY

1. Screened to MIL-PRF-38534. Class H and K and RHA L and R are pending product validation.

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]	RHA [3]
OPTIONS	SMP120	05, 28	S	O H K	O L R
FILL IN FOR MODEL # [4]	SMP120	_____	_____	/ _____	_____

Notes
1. Number of Outputs: S is a single output.
2. Screening: Screened to MIL-PRF-38534. Class H and K are pending product validation. A screening level of O is a Space Prototype and is only used with RHA O. See Table 6 and Table 7 for more information.
3. RHA: Screened to MIL-PRF-38534. RHA L and R are pending product validation. Interpoint model numbers use an “O” in the RHA designator position to indicate the “-” (dash) RHA level of MIL-PRF-38534, which is defined as “no RHA.” RHA O is only available with screening level O. See Table 7 for more information.
4. If ordering by model number add a “-Q” to request solder dipped leads (SMP12005S/KR-Q).

TABLE 3: MODEL NUMBER OPTIONS

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TABLE 4: OPERATING CONDITIONS - ALL MODELS, 120 VIN 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	—	+125	°C
	ABSOLUTE [1]	-55	—	+135	
DERATING OUTPUT POWER/CURRENT [1]	LINEARLY	From 100% at 125°C to 0% at 135°C			
ESD RATING [1, 2] MIL-PRF-38534, 3.9.5.8.2	MIL-STD-883 METHOD 3015 CLASS TBD, T_C = 25°C	—	—	TBD	V
ISOLATION: INPUT TO OUTPUT OR ANY PIN TO CASE EXCEPT CASE PIN	@ 500 VDC, T_C = 25°C	100	—	—	Megohms
UNDERVOLTAGE LOCKOUT [3]	RISING V_{IN} (TURN ON)	—	75	79	V
T_C = -55°C TO +125°C	FALLING V_{IN} (TURN OFF)	71	75	—	
CURRENT LIMIT T_C = -55°C TO +125°C	% OF FULL LOAD	110	—	145	%
AUDIO REJECTION [1]	T_C = 25°C	—	50	—	dB
OUTPUT VOLTAGE TRIM RANGE	SEE PAGE 5	—	±10	—	%
T_C = -55°C TO +125°C	NOT USED	LEAVE PIN OPEN			
SWITCHING FREQUENCY T_C = -55°C TO +125°C	OPERATING FREQUENCY	470	500	530	kHz
SYNCHRONIZATION [4] T_C = -55°C TO +125°C	INPUT FREQUENCY	480	—	550	kHz
SYNC IS FLOATING AND ISOLATED	DUTY CYCLE	30	—	70	%
T_C = -55°C TO +125°C	ACTIVE LOW	—	—	0.8	V
	ACTIVE HIGH	3	—	5	
	REFERENCED TO	SYNC RETURN			
	IF NOT USED	CONNECT TO SYNC RETURN			
INHIBIT ACTIVE LOW (OUTPUT DISABLED)	INHIBIT PIN PULLED LOW [1, 5]	—	—	1	V
T_C = -55°C TO +125°C	INHIBIT PIN SOURCE	—	—	500	µA
Do not apply a voltage to the inhibit pin	CURRENT [1]				
	REFERENCED TO	INPUT COMMON			
INHIBIT ACTIVE HIGH (OUTPUT ENABLED	INHIBIT PIN CONDITION	OPEN COLLECTOR OR UNCONNECTED			
T_C = -55°C TO +125°C					
Do not apply a voltage to the inhibit pin	OPEN INHIBIT PIN VOLTAGE [1]	10	12	13.6	V

Notes
1. Characterization test and/or analysis. Not a production test.
2. Passes TBD volts.
3. Input voltage should rise and fall no slower than 50 volts/ms. If this is not possible, the SMP120 should be inhibited prior to the removal of power. See section on Sequencing on page 4.
4. Can only be synchronized above the default operating frequency.
5. Tested with Inhibit pin at <1.0 volts.

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TABLE 5: ELECTRICAL CHARACTERISTICS: -55°C TO +125°C CASE, 120 VIN, 100% LOAD, UNLESS OTHERWISE SPECIFIED.

SINGLE OUTPUT MODELS		SMP12005S			SMP12028S			UNITS
PARAMETER	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	
OUTPUT VOLTAGE		4.90	5.00	5.10	27.4	28	28.6	V
OUTPUT CURRENT		—	—	8.0	—	—	1.75	A
OUTPUT POWER		—	—	40	—	—	49	W
OUTPUT RIPPLE	T_C = 25°C	—	50	75	—	25	85	mV p-p
10 kHz - 2 MHz	T_C = -55°C TO +125°C	—	—	100	—	—	85	
OUTPUT RIPPLE [2]	T_C = 25°C	—	50	175	—	50	125	mV p-p
10 kHz - 20 MHz	T_C = -55°C TO +125°C	—	—	175	—	—	125	
LINE REGULATION	V_{IN} = 80 TO 160 V	—	1	10	—	1	140	mV
LOAD REGULATION	NO LOAD TO FULL	—	1	10	—	25	140	mV
INPUT VOLTAGE	CONTINUOUS	80	120	160	80	120	160	V
	TRANSIENT 100 ms [1]	—	—	180	—	—	180	V
INPUT CURRENT	NO LOAD	—	—	75	—	—	75	mA
	INHIBITED	—	—	1.2	—	—	1.2	
INPUT RIPPLE CURRENT	10 kHz - 2 MHz	—	20	50	—	20	50	mA p-p
	10 kHz - 20 MHz	—	—	90	—	—	90	
EFFICIENCY	T_C = 25°C	72	75	—	80	83	—	%
	T_C = -55°C to +125°C	71	—	—	78	—	—	
LOAD FAULT [3, 4]	POWER DISSIPATION	—	7	12	—	5	12	W
	RECOVERY	—	—	25	—	—	25	ms
STEP LOAD RESPONSE [4, 5, 6]	TRANSIENT	—	—	±350	—	—	±1000	mV pk
50% - 100% - 50%	RECOVERY	—		500	—	—	500	µs
STEP LINE RESPONSE [1, 4, 7]	TRANSIENT	—	±100	—	—	±400	—	mV pk
V_{IN} = 80 - 160 - 80	RECOVERY	—	500	—	—	500	—	µs
START-UP [4, 8]	DELAY	—	—	25	—	—	25	ms
	OVERSHOOT	—	—	50	—	—	280	mV pk
CAPACITIVE LOAD [9, 10] T_C = 25°C	UNCONDITIONALLY STABLE, START-UP DELAY INCREASED	—	—	1000	—	—	200	µF

Notes
1. Characterization test and/or analysis. Not a production test.
2. 20 MHz ripple measured with 0.01 µF capacitor connected as close as possible to V_{OUT} an V_{OUT} return pins.
3. Maximum power dissipation when output is shorted.
4. Recovery and start-up times are measured from application of the transient, or change in condition, to the point at which V_{OUT} is within 1% of final value.
5. Step load transition test is performed with load current rise time at 10 microseconds typical.
6. Half load to/from full load.
7. Step line test is performed with input voltage rise time at 100 microseconds ± 20 microseconds.
8. Measured from release of inhibit or input voltage step.
9. Minimum ESR: 0.05 ohms for 5 volt, 0.1 ohms for 28 volt.
10. Maximum ESR: 0.5 ohms for 5 volt, 1.0 ohms for 28 volt.

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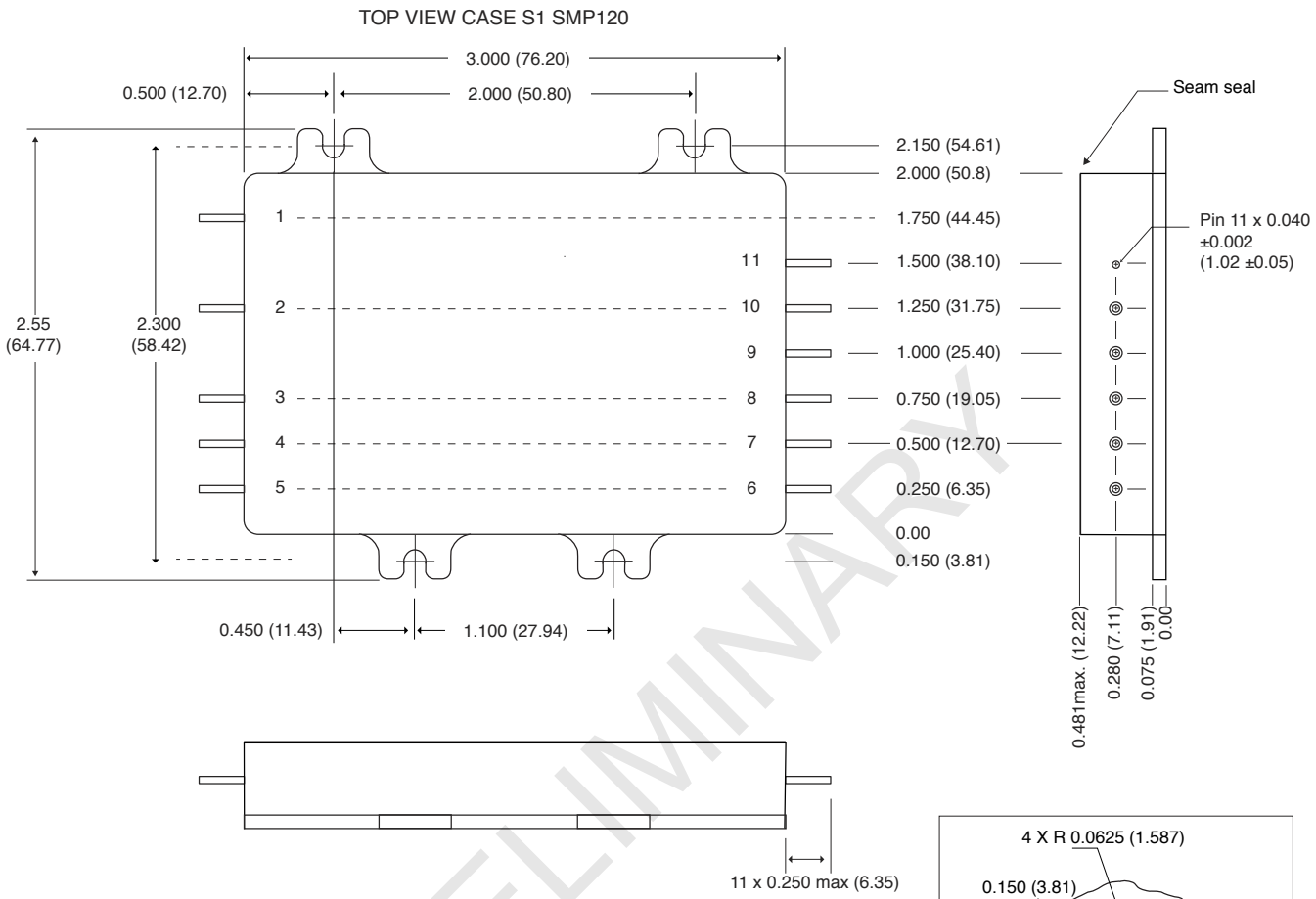

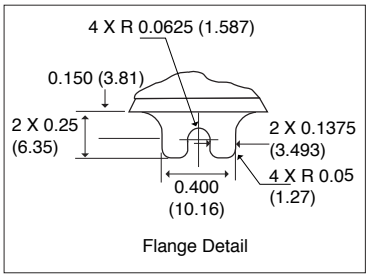

Weight: 140 grams typical

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	Copper cored 3:1 alloy 52, glass compression seal Gold plating of 50 - 150 microinches included in pin diameter Seal hole 0.091 ±0.002 (2.31 ±0.051)

Please refer to the numerical dimensions for accuracy.

FIGURE 12: CASE S1

SMP120 Single Output Space DC-DC Converters

PRELIMINARY – 80 TO 160 VOLT INPUT – 49 WATT

ELEMENT EVALUATION SPACE DC-DC CONVERTERS PROTOTYPE, CLASS H AND CLASS K

	NON-QML [1]	QML [2]			
	PROTOTYPE	CLASS H		CLASS K	
	/O	/H		/K	
COMPONENT-LEVEL TEST PERFORMED	M/S [3]	M/S [3]	P [4]	M/S [3]	P [4]
Element Electrical	■	■	■	■	■
Visual		■	■	■	■
Internal Visual		■		■	
Temperature Cycling				■	■
Constant Acceleration				■	■
Interim Electrical				■	
Burn-in				■	
Post Burn-in Electrical				■	
Steady State Life				■	
Voltage Conditioning Aging					■
Visual Inspection					■
Final Electrical		■	■	■	■
Wire Bond Evaluation		■	■	■	■
SEM				■	

Notes
1. Non-QML products may not meet all of the requirements of MIL-PRF-38534.
2. Screened to MIL-PRF-38534. Class H and K are pending product validation.
3. M/S = Active components (microcircuit and semiconductor die)
4. P = Passive components, Class H and K element evaluation. Not applicable to space prototype (“O”) element evaluation.

Definitions
Element Evaluation: Component testing/screening per MIL-STD-883 as determined by MIL-PRF-38534
SEM: scanning electron microscopy

TABLE 6: ELEMENT EVALUATION

SMP120 Single Output Space DC-DC Converters

PRELIMINARY – 80 TO 160 VOLT INPUT – 49 WATT

Environmental Screening Space DC-DC Converters Prototype, Class H and Class K

	NON-QML [1]	QML [2, 3]			
	PROTOTYPE	CLASS H		CLASS K	
TEST PERFORMED	/OO [4]	/HL	/HR	/KL	/KR
Non-destruct wire bond pull, Method 2023		■ [5]	■ [5]	■	■
Pre-cap Inspection, Method 2017, 2032	■	■	■	■	■
Temperature Cycle (10 times)					
Method 1010, Cond. C, -65°C to +150°C, ambient	■	■	■	■	■
Constant Acceleration					
Method 2001, 3000 g	■	■	■	■	■
PIND, Test Method 2020, Cond. A		■ [5]	■ [5]	■	■
Pre burn-in test, Group A, Subgroups 1 and 4	■	■ [5]	■ [5]	■	■
Burn-in Method 1015, +125°C case, typical [6]					
96 hours	■				
160 hours		■	■		
2 x 160 hours (includes mid-BI test)				■	■
Final Electrical Test, MIL-PRF-38534, Group A,					
Subgroups 1 and 4: +25°C case	■				
Subgroups 1 through 6, -55°C, +25°C, +125°C case		■	■	■	■
Hermeticity Test, Method 1014					
Gross Leak, Cond. B_2, Kr85				■	■
Gross Leak, Cond. C_1, fluorocarbon	■	■	■		
Fine Leak, Cond. B_1, Kr85				■	■
Fine Leak, Cond. A_2, helium	■	■	■		
Radiography, Method 2012				■	■
Post Radiography Electrical Test, +25°C case				■ [5]	■ [5]
Final visual inspection, Method 2009	■	■	■	■	■

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

Notes
1. Non-QML prototype products may not meet all of the requirements of MIL-PRF-38534.
2. All processes are QML qualified and performed by certified operators.
3. Screened to MIL-PRF-38534. Class H, Class K, RHA L, RHA R, and SEE are pending product validation.
4. "O" in the RHA designator position in Interpoint model numbers indicates DLA RHA "-" defined as no RHA.
5. Not required by DLA but performed to assure product quality.
6. Burn-in temperature designed to bring the case temperature to +125°C minimum. Burn-in is a powered test.

TABLE 7: ENVIRONMENTAL SCREENING SPACE DC-DC CONVERTERS PROTOTYPE, CLASS H AND CLASS K

SMP120 Single Output Space DC-DC Converters

PRELIMINARY – 80 TO 160 VOLT INPUT – 49 WATT

SPACE RADIATION HARDNESS ASSURANCE SCREENING DC-DC CONVERTERS CLASS H AND CLASS K, RHA [1] L AND R

	NON-QML [2]	QML [3]			
	PROTOTYPE	CLASS H		CLASS K	
QUALIFICATION PER MIL-STD	/OO [4]	/HL	/HR	/KL	/KR
RHA L: 50 krad(Si) total dose [1, 5, 6]		■		■	
RHA R: 100 krad(Si) total dose [1, 5, 6]			■		■
SEE, LET 43 MeV cm^2/mg [1, 7]		■	■	■	■

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

Notes
1. Our Redmond facility has a DLA approved RHA plan for Interpoint power products. Our SMD products with RHA “L” or “R” code meet DLA requirements.
2. Non-QML prototype products may not meet all of the requirements of MIL-PRF-38534.
3. Screened to MIL-PRF-38534. Class H, Class K, RHA L, RHA R, and SEE are pending product validation,
4. “O” in the RHA designator position in Interpoint model numbers indicates DLA RHA “-” defined as no RHA.
5. Radiation sensitive components internal to the devices are procured with radiation guarantees or undergo radiation lot acceptance testing (RLAT) performed per condition A, method 1019 of MIL-STD-883.
6. A representative converter was high dose rate (HDR) tested using condition A of method 1019 of MIL-STD-883 to 150 krads(Si) to ensure RHA designator level “R” (100 krad(Si)). Pending product validation.
7. Single event testing was performed on a converter to 43 MeV-cm^2/mg using 15 MeV/nucleon gold ions with no latch-up, burn-out, functional interrupts, or gate ruptures exhibited. Single event upsets (output voltage transients) may be present up to 43 MeV-cm^2/mg. Pending product validation.

TABLE 8: SPACE RADIATION HARDNESS ASSURANCE DC-DC CONVERTERS CLASS H AND CLASS K, RHA L AND R