

# SMSA Single and Dual DC-DC Converter

## 16 TO 40 VOLT INPUT - 5 WATT

### FEATURES

- Radiation tolerant space DC-DC converter
  - Single event effects (SEE) LET performance to 86 MeV cm<sup>2</sup>/mg
  - Total ionizing dose (TID) guaranteed per MIL-STD-883 method 1019, radiation hardness assurance (RHA)
    - P = 30 krad(Si), 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)
- Operating temperature -55°C to +125°C
- Qualified to MIL-PRF-38534 Class H and K
- Input voltage range 16 to 40 volts
- Transient protection 50 volts for 50 ms
- Fully isolated
- Fixed high frequency switching
- Inhibit function
- Indefinite short circuit protection
- High power density, up to 74% typical efficiency
- Soft-start function limits inrush current during startup



MODELS	
OUTPUT VOLTAGE (V)	
SINGLE	DUAL
3.3	±5
5	±12
5.2	±15
12	
15	

### DESCRIPTION

The Interpoint® SMSA Series™ of DC-DC converters offers up to 5 watts of power in a radiation tolerant design. The low profile SMSA 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. Thick-film hybrid techniques provide military/aerospace reliability levels and optimum miniaturization. The hermetically sealed case is 1.075 inches ( by 1.075 inches with a height of 0.270 inches. Power density for the SMSA Series converters is 16 watts per cubic inch.

### SCREENING

SMSA converters offer screening to space prototype (O), Class H or K, radiation hardness assurance (RHA) levels P - 30 krad(Si), L - 50 krad(Si) or R - 100 krad(Si). Single event effects (SEE) LET performance to 86 MeV cm<sup>2</sup>/mg. See Table 10 on page 16 for more information.

### CONVERTER DESIGN

The SMSA converters are switching regulators that use a flyback converter design with a constant switching frequency of 500 kHz. They are regulated, isolated units using a pulse width modulated topology. Isolation between input and output circuits is provided with a transformer in the forward power loop and an optical link in the feedback control loop. Excellent input line transient response and audio rejection is achieved by an advanced feed-forward compensation technique.

On dual output models negative output regulation is maintained by tightly coupled magnetics.

### PROTECTION FEATURES

Predictable current limit is accomplished by direct monitoring of the output load current, which results in a constant current output above the overload point. Internal input and output filters eliminate the need for external capacitors.

All models include a soft-start function to prevent large current draw and minimize overshoot.

### WIDE VOLTAGE RANGE

The SMSA converters are designed to provide full power operation over the full 16 to 40 volt range. An undervoltage lockout feature keeps the converter shutdown below approximately 13 volts to ensure smooth initialization.

### SPAN VOLTAGE ON DUALS

Dual outputs may be spanned to increase the output voltage by configuring the converter as a single output. The positive output is used as one rail and the negative output is used as the other rail. As an example the positive and negative 15 volt dual can be configured as a single 30 volt output. This can be used as a positive 30 volt output or a negative 30 volt output. In all cases Output Common of the converter is not connected.

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If the dual is configured as a positive 30 volt output the negative output would be used as system ground and the positive output would be used as the positive 30 volt output. If the dual is configured as a negative 30 volt output the positive output would be used as system ground and the negative output would be used as the negative 30 volt output.

The maximum capacitance when using a span voltage on a dual is half the value specified for each output.

#### DYNAMIC RESPONSE

The SMSA feed-forward compensation system provides excellent dynamic response and audio rejection. Audio rejection is typically 50 dB (Figure 17 on page 12).

#### INHIBIT FUNCTION

SMSA converters provide an inhibit feature that can be used to disable internal switching and inhibit the unit's output. Inhibiting in this manner results in low standby current, and no generation of switching noise.

The converter is inhibited when an active low ( $\leq 0.8$  V) is applied to the inhibit pin. The unit is enabled when the pin, which is internally connected to a pull-up resistor, is left unconnected or is connected to an open collector gate. The open circuit output voltage associated with the inhibit pin is 9 to 11 volts. In the inhibit mode, a maximum of 4 mA must be sunk from the inhibit pin at 28 volt input.

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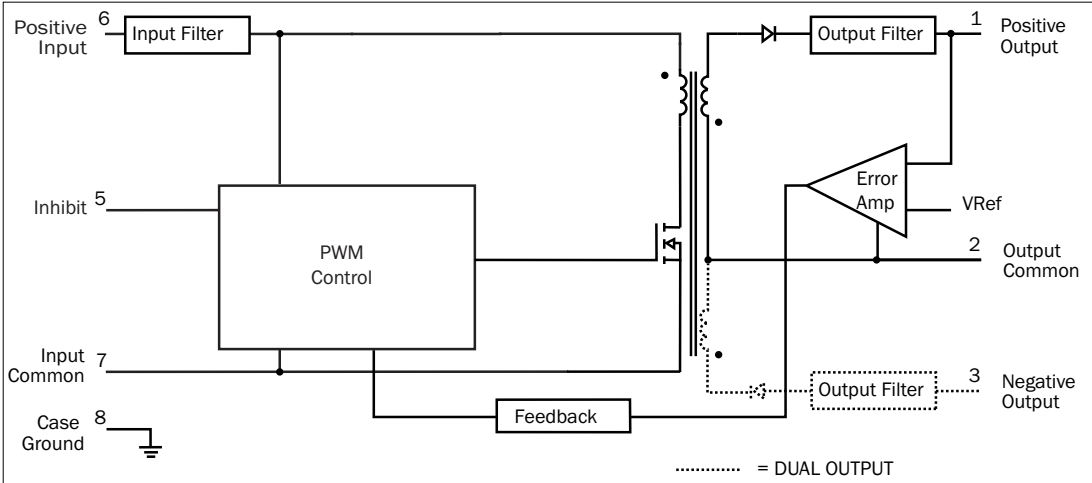


FIGURE 1: SMSA BLOCK DIAGRAM

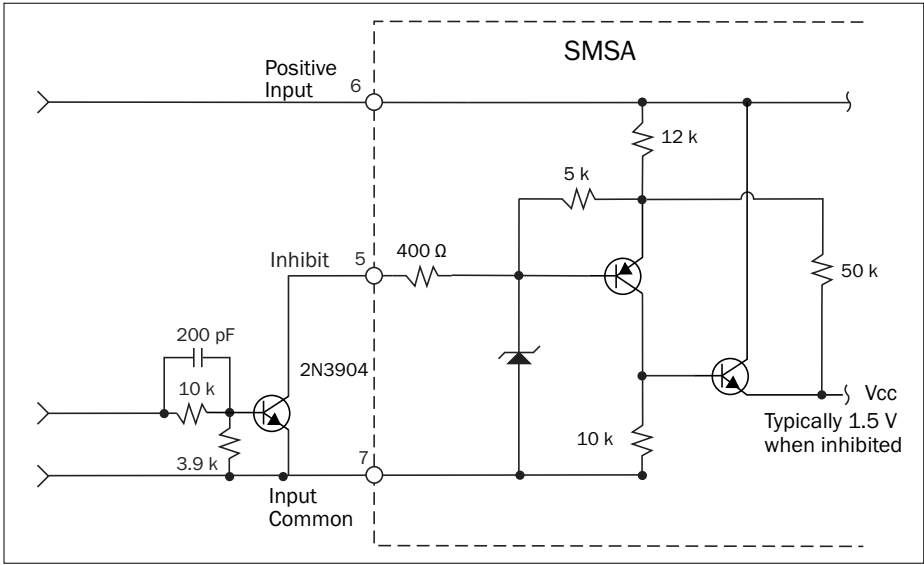


FIGURE 2: INHIBIT INTERFACE

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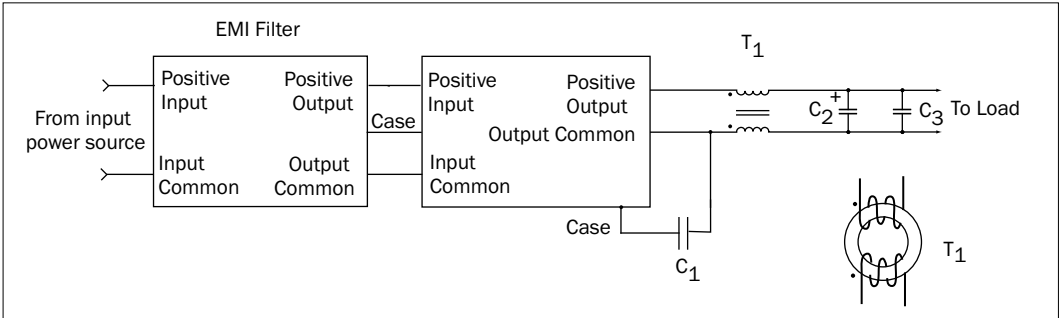


FIGURE 3: LOW NOISE OUTPUT FILTER FOR SMSA SINGLE OUTPUT MODEL

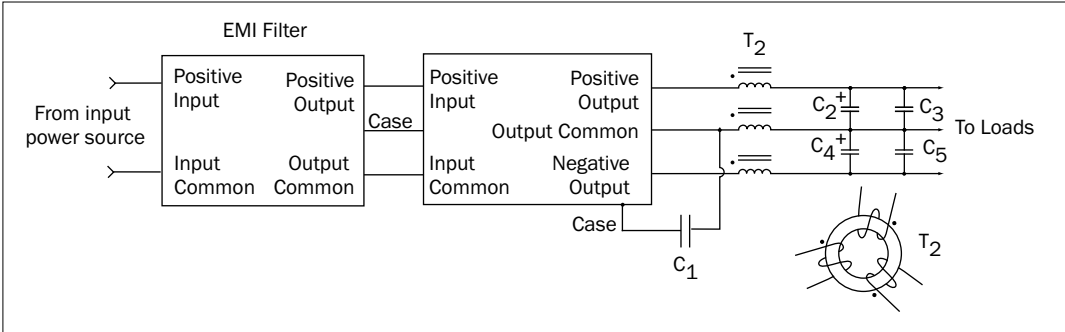


FIGURE 4: LOW NOISE OUTPUT FILTER FOR SMSA DUAL OUTPUT MODEL

The filter suggestions in Figure 3 and Figure 4 will further reduce the output ripple for systems requiring very low output noise.

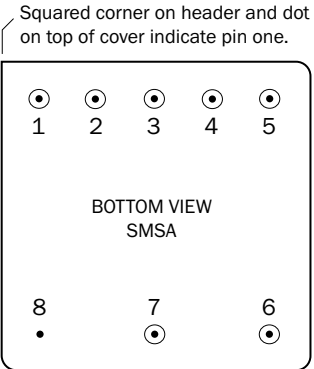
- C1 = 0.27  $\mu$ F ceramic capacitor, 500 V
  - C2 = C4 = 6.8  $\mu$ F tantalum capacitor
  - C3 = C5 = 0.27  $\mu$ F ceramic capacitor
  - Single output: T1 = 15T #28 AWG winding on toroid,  $\mu_i = 5000$
  - Dual output: T2 = 10T #28 AWG winding on toroid,  $\mu_i = 5000$
- For best results, make interconnections as short as possible.

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<b>PIN OUT</b>		
<b>Pin</b>	<b>Single Output</b>	<b>Dual Output</b>
1	Positive Output	Positive Output
2	Output Common	Output Common
3	No connection	Negative Output
4	No connection	No connection
5	Inhibit	Inhibit
6	Positive Input	Positive Input
7	Input Common	Input Common
8	Case Ground	Case Ground

TABLE 1: PIN OUT



See Figure 24 on page 14 for dimensions.

FIGURE 5: PIN OUT BOTTOM VIEW

<b>PINS NOT IN USE</b>	
Inhibit	Leave unconnected
“No Connection” pins	No electrical connection

TABLE 2: PINS NOT IN USE

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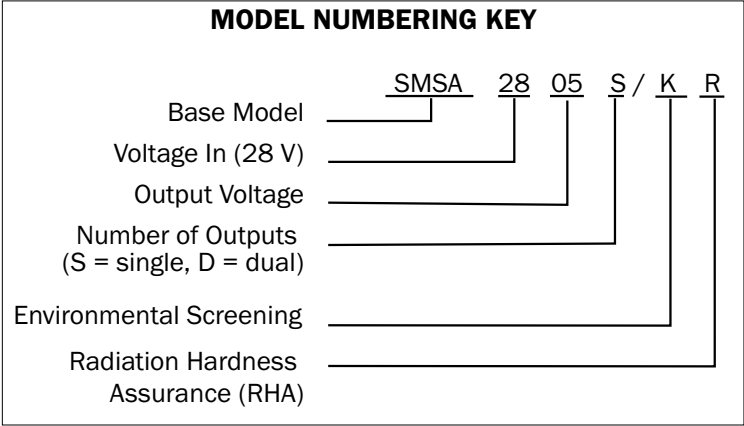


FIGURE 6: MODEL NUMBERING KEY

<b>SMD NUMBERS</b>	
STANDARD MICROCIRCUIT DRAWING (SMD)	SMSA SIMILAR PART
5962R0621001KXC	SMSA283R3S/KR
5962R9309202KXC	SMSA2805S/KR
5962R1421601KXC	SMSA285R2S/KR
5962R9309302KXC	SMSA2812S/KR
5962R9309402KXC	SMSA2815S/KR
5962R0052202KXC	SMSA2805D/KR
5962R9308902KXC	SMSA2812D/KR
5962R9309002KXC	SMSA2815D/KR

The SMD numbers shown are for RHA level R, screening level Class K, standard case (X), standard pin seal and non-solder dipped pins (C). For other options please refer to the SMD for the SMD number and the vendor similar number. All SMD numbers are listed on the SMD in the "Bulletin" which is the last page of the SMD. For exact specifications for an SMD product, refer to the SMD. SMDs can be downloaded from <https://landandmaritimeapps.dla.mil/programs/smcr>

TABLE 3: SMD NUMBER CROSS REFERENCE

<b>MODEL NUMBER OPTIONS</b>					
<b>ON THE LINES BELOW, ENTER ONE SELECTION FROM EACH CATEGORY TO DETERMINE THE MODEL NUMBER.</b>					
CATEGORY	Base Model and Input Voltage	Output Voltage <sup>1</sup>	Number of Outputs <sup>2</sup>	Screening <sup>3</sup>	RHA <sup>4</sup>
<b>OPTIONS</b>	SMSA28	3R3, 05, 5R2, 12, 15	S	O	O
		05, 12, 15	D	H	P
				K	L R
<b>FILL IN FOR MODEL # <sup>5</sup></b>	<u>SMSA28</u>	_____	_____	/ _____	_____

Notes

1. An R indicates a decimal point. 3R3 is 3.3 volts out. The values of 3.3 and 5.2 are only available in single output models.
2. Number of Outputs: S is a single output and D is a dual output.
3. Screening: A screening level of O is a space prototype and is only used with RHA O. See Table 9 on page 15 for more information.
4. RHA: Interpoint model numbers use an "O" in the RHA designator position to indicate the "-" (dash) radiation hardness assurance level of MIL-PRF-38534, which is defined as "no RHA." RHA O is only available with screening level O. See Table 10 on page 16 for more information.
5. If ordering by model number add suffix "-Q" to request solder dipped leads (SMSA2805S/KR-Q).

TABLE 4: MODEL NUMBER OPTIONS

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TABLE 5: OPERATING CONDITIONS - ALL MODELS, 25 °C CASE, 28 VIN, UNLESS OTHERWISE SPECIFIED.

SMSA SERIES		ALL MODELS				
PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS	
LEAD SOLDERING TEMPERATURE <sup>1</sup>	10 SECONDS MAX.	–	–	300	°C	
STORAGE TEMPERATURE		-65	–	+150	°C	
CASE OPERATING TEMPERATURE	FULL POWER	-55	–	+125	°C	
	ABSOLUTE <sup>1</sup>	-55	–	+135		
DERATING OUTPUT POWER/CURRENT <sup>1</sup>	LINEARLY	From 100% at 125 °C to 0% at 135 °C				
ESD RATING <sup>1, 2</sup> MIL-PRF-38534, 3.9.5.8.2	MIL-STD-883 METHOD 3015 CLASS 2	2000 - 3999			V	
ISOLATION: INPUT TO OUTPUT, INPUT TO CASE, OUTPUT TO CASE <sup>3</sup>	@ 500 VDC AT 25 °C	100	–	–	Megohms	
INPUT TO OUTPUT CAPACITANCE <sup>1</sup>		–	50	–	pF	
UNDER VOLTAGE LOCKOUT <sup>1</sup>	V <sub>IN</sub>	–	13	–	V	
CURRENT LIMIT <sup>4</sup>	% OF FULL LOAD	–	166	–	%	
AUDIO REJECTION <sup>1</sup>		–	50	–	dB	
SWITCHING FREQUENCY	-55 °C TO +125 °C	400	500	600	kHz	
INHIBIT ACTIVE LOW (OUTPUT DISABLED) Do not apply a voltage to the inhibit pin	INHIBIT PIN PULLED LOW <sup>1</sup>	–	–	0.8	V	
	INHIBIT PIN SOURCE CURRENT <sup>1</sup>	–	–	4	mA	
	REFERENCED TO	INPUT COMMON				
INHIBIT ACTIVE HIGH (OUTPUT ENABLED) Do not apply a voltage to the inhibit pin	INHIBIT PIN CONDITION	OPEN COLLECTOR OR UNCONNECTED				
	OPEN INHIBIT PIN VOLTAGE <sup>1</sup>	9	–	11	V	

For mean time between failures (MTBF) contact Applications Engineering at [powerapps@craneae.com](mailto:powerapps@craneae.com)

#### Notes

1. Guaranteed by characterization test and/or analysis. Not a production test.
2. Passes 2000 volts.
3. 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.
4. Current limit is defined as the point at which the output voltage decreases by 1%.

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TABLE 6: ELECTRICAL CHARACTERISTICS -55 °C TO +125 °C CASE, 28 VIN, 100% LOAD, UNLESS OTHERWISE SPECIFIED.

SINGLE OUTPUT MODELS		SMSA283R3S			SMSA2805S			SMSA285R2S			UNITS
PARAMETER	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
OUTPUT VOLTAGE		3.15	3.30	3.45	4.80	5.00	5.20	4.99	5.20	5.39	V
OUTPUT CURRENT	V <sub>IN</sub> = 16 TO 40 V	0	–	1200	0	–	1000	0	–	962	mA
OUTPUT POWER	V <sub>IN</sub> = 16 TO 40 V	–	–	4.0	–	–	5.0	–	–	5.0	W
OUTPUT RIPPLE 10 kHz - 2 MHz	T <sub>C</sub> = 25 °C	–	300	600	–	150	450	–	150	450	mV p-p
	T <sub>C</sub> = -55 °C TO +125 °C	–	–	900	–	–	675	–	–	675	
LINE REGULATION	V <sub>IN</sub> = 16 TO 40 V	–	10	50	–	10	50	–	10	50	mV
LOAD REGULATION	NO LOAD TO FULL	–	10	50	–	10	50	–	10	50	mV
INPUT VOLTAGE	CONTINUOUS	16	28	40	16	28	40	16	28	40	V
NO LOAD TO FULL	TRANSIENT <sup>1</sup> 50 ms	0	–	50	0	–	50	0	–	50	
INPUT CURRENT <sup>2</sup>	NO LOAD	–	35	50	–	35	50	–	35	60	mA
	INHIBITED	–	3	5	–	3	5	–	3	5	
	INHIBITED 50 kRAD <sup>3</sup>	–	5	7	–	5	7	–	5	7	
INPUT RIPPLE CURRENT <sup>4</sup>	10 kHz - 10 MHz	–	60	100	–	60	150	–	60	150	mA p-p
EFFICIENCY	T <sub>C</sub> = 25 °C	60	–	–	64	74	–	64	74	–	%
	T <sub>C</sub> = -55 °C TO +125 °C	60	–	–	62	–	–	62	–	–	
LOAD FAULT <sup>5, 6</sup>	POWER DISSIPATION	–	1.5	2.5	–	1.5	2.2	–	1.5	2.2	W
SHORT CIRCUIT	RECOVERY <sup>1</sup>	–	12.5	75	–	12.5	75	–	12.5	75	ms
STEP LOAD RESPONSE <sup>6, 7</sup> 50% - 100% - 50%	TRANSIENT	–	±200	±500	–	200	±1500	–	±200	±1500	mV pk
	RECOVERY <sup>1</sup>	–	200	500	–	200	4500	–	200	4500	µs
STEP LINE RESPONSE <sup>1, 6, 8</sup> 16 - 40 - 16 V	TRANSIENT	–	±200	±500	–	±200	±500	–	±200	±500	mV pk
	RECOVERY	–	400	500	–	400	1000	–	400	1000	µs
START-UP <sup>6, 9</sup>	DELAY	–	10	30	–	10	30	–	10	30	ms
	OVERSHOOT <sup>1</sup>	–	0	200	–	0	200	–	0	200	mV pk
CAPACITIVE LOAD <sup>1</sup> T <sub>C</sub> = 25 °C	NO EFFECT ON DC PERFORMANCE	–	–	500	–	–	300	–	–	300	µF

## Notes

- Guaranteed by characterization test and/or analysis. Not a production test.
- The inhibited input current is tested with <0.8 volts on the inhibit.
- For RHA L, 50 krad converters, the pre-radiation spec for lin Inhibit is as stated in the table.
- Tested with a 2 µH external input inductor.
- Indefinite short circuit protection not guaranteed above 125 °C (case).

- Recovery time is measured from application of the transient to point at which V<sub>OUT</sub> is within 1% of V<sub>OUT</sub> at final value.
- Step load test is performed at 10 microseconds typical.
- Step line test is performed at 100 microseconds ± 20 microseconds.
- Tested on release from inhibit.



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TABLE 7: ELECTRICAL CHARACTERISTICS -55 °C TO +125 °C CASE, 28 VIN, 100% LOAD, UNLESS OTHERWISE SPECIFIED.

SINGLE OUTPUT MODELS		SMSA2812S			SMSA2815S			UNITS
PARAMETER	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	
OUTPUT VOLTAGE		11.64	12.00	12.36	14.40	15.00	15.60	V
OUTPUT CURRENT	$V_{IN} = 16$ TO 40 V	—	—	417	—	—	333	mA
OUTPUT POWER	$V_{IN} = 16$ TO 40 V	—	—	5.0	—	—	5.0	W
OUTPUT RIPPLE	$T_C = 25^\circ\text{C}$	—	125	200	—	150	500	mV p-p
10 kHz - 2 MHz	$T_C = -55^\circ\text{C}$ TO $+125^\circ\text{C}$	—	—	300	—	—	525	
LINE REGULATION	$V_{IN} = 16$ TO 40 V	—	10	50	—	10	50	mV
LOAD REGULATION	NO LOAD TO FULL	—	10	50	—	10	50	mV
INPUT VOLTAGE	CONTINUOUS	16	28	40	16	28	40	V
NO LOAD TO FULL	TRANSIENT <sup>1</sup> 50 ms	0	—	50	0	—	50	
INPUT CURRENT <sup>2</sup>	NO LOAD	—	35	42	—	35	50	mA
	INHIBITED	—	3	5	—	3	5	
	INHIBITED 50 kRAD <sup>3</sup>	—	5	7	—	5	7	
INPUT RIPPLE CURRENT <sup>4</sup>	10 kHz - 10 MHz	—	60	100	—	60	250	mA p-p
EFFICIENCY	$T_C = 25^\circ\text{C}$	70	74	—	71	74	—	%
	$T_C = -55^\circ\text{C}$ TO $+125^\circ\text{C}$	68	—	—	65	—	—	
LOAD FAULT <sup>5, 6</sup>	POWER DISSIPATION	—	1.2	2.1	—	1.2	2.0	W
SHORT CIRCUIT	RECOVERY <sup>1</sup>	—	1	10	—	1	10	ms
STEP LOAD RESPONSE <sup>6, 7</sup>	TRANSIENT	—	±300	±400	—	±400	±3000	mV pk
50% - 100% - 50%	RECOVERY <sup>1</sup>	—	400	500	—	400	4500	µs
STEP LINE RESPONSE <sup>1, 6, 8</sup>	TRANSIENT	-1000	250	800	-500	250	500	mV pk
16 - 40 - 16 V	RECOVERY	—	700	800	—	500	1300	µs
START-UP <sup>6, 9</sup>	DELAY	—	10	30	—	10	30	ms
	OVERSHOOT <sup>1</sup>	—	0	500	—	0	500	mV pk
CAPACITIVE LOAD <sup>1</sup>	NO EFFECT ON DC PERFORMANCE	—	—	500	—	—	500	µF
	$T_C = 25^\circ\text{C}$							

## Notes

1. Guaranteed by characterization test and/or analysis. Not a production test.
2. The inhibited input current is tested with <0.8 volts on the inhibit.
3. For RHA L, 50 krad converters, the pre-radiation spec for lin inhibit is 7 mA max.
4. Tested with a 2 µH external input inductor.
5. Indefinite short circuit protection not guaranteed above 125 °C (case).

6. Recovery time is measured from application of the transient to point at which  $V_{OUT}$  is within 1% of  $V_{OUT}$  at final value.
7. Step load test is performed at 10 microseconds typical.
8. Step line test is performed at 100 microseconds ± 20 microseconds.
9. Tested on release from inhibit.

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TABLE 8: ELECTRICAL CHARACTERISTICS -55 °C TO +125 °C CASE, 28 VIN, 100% LOAD, UNLESS OTHERWISE SPECIFIED.

DUAL OUTPUT MODELS		SMSA2805D			SMSA2812D			SMSA2815D			UNITS
PARAMETER	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
OUTPUT VOLTAGE	+V <sub>OUT</sub>	4.90	5.00	5.10	11.64	12.00	12.36	14.40	15.00	15.60	V
	-V <sub>OUT</sub>	4.85	5.00	5.15	11.44	12.00	12.56	14.28	15.00	15.89	
OUTPUT CURRENT <sup>2</sup> V <sub>IN</sub> = 16 TO 40 V	EITHER OUTPUT	–	±500	800 <sup>1</sup>	–	±208	333 <sup>1</sup>	–	±167	267 <sup>1</sup>	mA
	TOTAL			1000			417			333	
OUTPUT POWER <sup>2</sup> V <sub>IN</sub> = 16 TO 40 V	EITHER OUTPUT	–	±2.5	4.0 <sup>1</sup>	–	±2.5	4.0 <sup>1</sup>	–	±2.5	4.0 <sup>1</sup>	W
	TOTAL			5.0			5.0			5.0	
OUTPUT RIPPLE 10 kHz - 2 MHz	T <sub>C</sub> = 25 °C	–	–	300	–	80	150	–	120	300	mV p-p
	T <sub>C</sub> = -55 °C TO +125 °C	–	–	300	–	–	300	–	–	400	
LINE REGULATION V <sub>IN</sub> = 16 TO 40 V	+V <sub>OUT</sub>	–	20	30	–	10	12	–	10	50	mV
	-V <sub>OUT</sub>	–	40	50	–	40	60	–	40	180	
LOAD REGULATION NO LOAD TO FULL	+V <sub>OUT</sub>	–	10	50	–	10	12	–	10	50	mV
	-V <sub>OUT</sub>	–	100	200	–	100	120	–	–	200	
CROSS REGULATION <sup>3</sup>		–	–	750	–	–	1000	–	–	1000	mV
INPUT VOLTAGE NO LOAD TO FULL	CONTINUOUS	16	28	40	16	28	40	16	28	40	V
	TRANSIENT <sup>1</sup> 50 MS	0	–	50	0	–	50	0	–	50	
INPUT CURRENT <sup>4</sup>	NO LOAD	–	30	50	–	40	50	–	38	50	mA
	INHIBITED	–	3	5	–	3	5	–	3	5	
	INHIBITED 50 KRAD <sup>5</sup>	–	5	7	–	5	7	–	5	7	
INPUT RIPPLE CURRENT <sup>6</sup>	10 kHz - 10 MHz	–	60	200	–	60	250	–	60	200	mA p-p
EFFICIENCY	T <sub>C</sub> = 25 °C	66	70	–	69	73	–	70	73	–	%
	T <sub>C</sub> = -55 °C TO +125 °C	65	–	–	69	–	–	68	–	–	
LOAD FAULT <sup>7, 8</sup>	POWER DISSIPATION	–	1.3	2.1	–	1.3	1.9	–	1.3	1.8	W
SHORT CIRCUIT	RECOVERY <sup>1</sup>	–	–	50	–	1	30	–	1	50	ms
STEP LOAD RESPONSE <sup>8, 9</sup> 50% - 100% - 50%	TRANSIENT	–	±200	±500	–	±200	±600	–	±200	±900	mV pk
	RECOVERY <sup>1</sup>	–	200	600	–	200	500	–	200	800	µs
STEP LINE RESPONSE <sup>1, 8, 10</sup> 16 - 40 - 16 V	TRANSIENT	–	±200	±750	–	±200	±500	–	±600	±1500	mV pk
	RECOVERY	–	500	1200	–	500	2000	–	500	1200	µs
START-UP <sup>8, 11</sup>	DELAY	–	–	10	–	–	8	–	–	8	ms
	OVERSHOOT <sup>1</sup>	–	0	750	–	0	500	–	0	750	mV pk
CAPACITIVE LOAD <sup>1, 12</sup> T <sub>C</sub> = 25 °C	NO EFFECT ON DC PERFORMANCE	–	–	100	–	–	100	–	–	100	µF

### Notes

- Guaranteed by characterization test and/or analysis. Not a production test.
- Up to 4 watts (80% of full power) is available from either output providing the opposite output is carrying 20% of total power.
- Shows the effect on the minus output during the defined loading conditions: Measure -V<sub>out</sub> for ±I<sub>out</sub> = 0.5 amps. Then compare with: a) -V<sub>out</sub> for +I<sub>out</sub> = 0.7 amps; -I<sub>out</sub> = 0.3 amps and b) -V<sub>out</sub> for +I<sub>out</sub> = 0.3 amps; -I<sub>out</sub> = 0.7 amps. See Figure 21, Figure 22 and Figure 23 on page 13.
- The inhibited input current is tested with <0.8 volts on the inhibit.
- For RHA L, 50 krad converters, the pre-radiation spec for I<sub>in</sub> Inhibit is 7 mA max.
- Tested with a 2 µH external input inductor.
- Indefinite short circuit protection not guaranteed above 125 °C (case).
- Recovery time is measured from application of the transient to point at which V<sub>OUT</sub> is within 1% of V<sub>OUT</sub> at final value.
- Step load test is performed at 10 microseconds typical.
- Step line test is performed at 100 microseconds ± 20 microseconds.
- Tested on release from inhibit.
- Applies to each output.

# SMSA Single and Dual DC-DC Converter

## 16 TO 40 VOLT INPUT - 5 WATT

TYPICAL PERFORMANCE PLOTS: 28 VIN, 25 °C CASE, 100% LOAD, UNLESS OTHERWISE SPECIFIED.  
These are examples for reference only and are not guaranteed specifications.

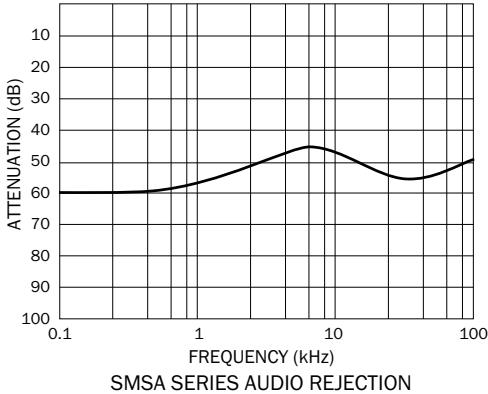


FIGURE 7

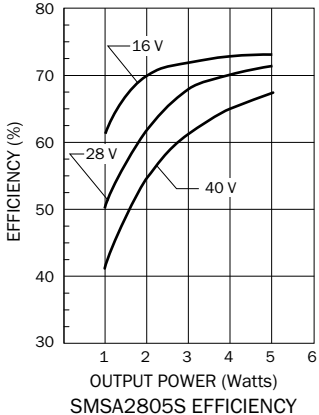


FIGURE 8

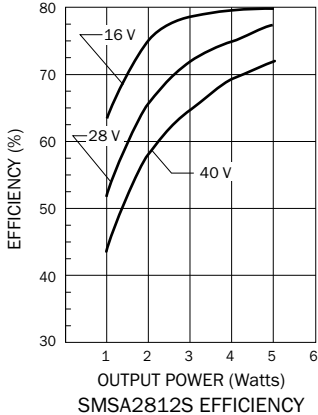


FIGURE 9

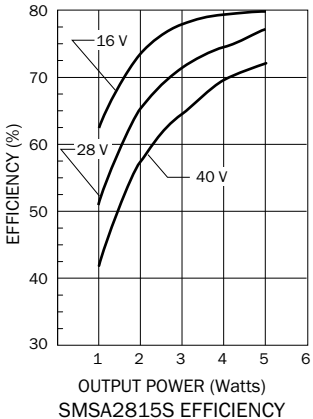


FIGURE 10

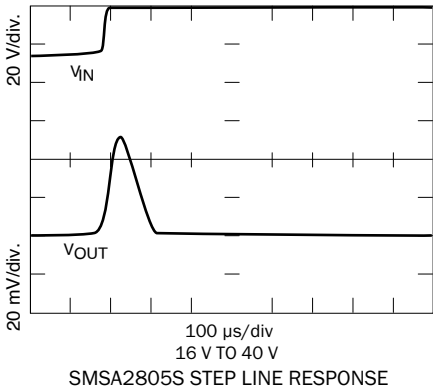


FIGURE 11

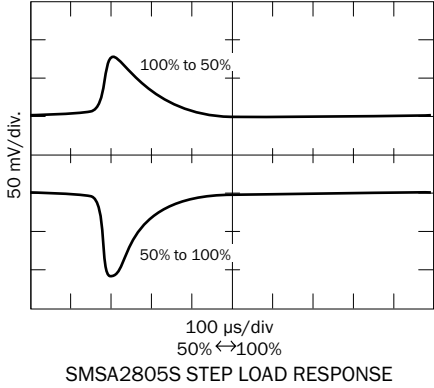


FIGURE 12

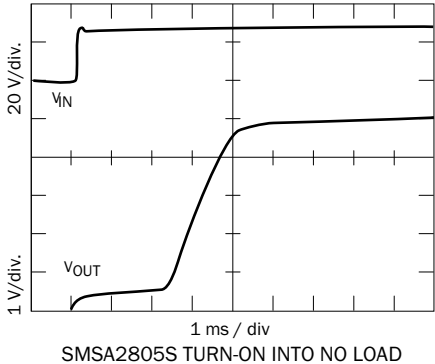


FIGURE 13

# SMSA Single and Dual DC-DC Converter

## 16 TO 40 VOLT INPUT - 5 WATT

TYPICAL PERFORMANCE PLOTS: 28 VIN, 25 °C CASE, 100% LOAD, UNLESS OTHERWISE SPECIFIED.  
These are examples for reference only and are not guaranteed specifications.

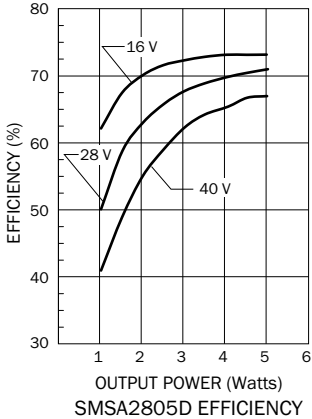


FIGURE 14

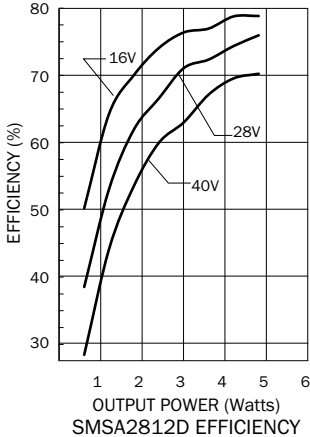


FIGURE 15

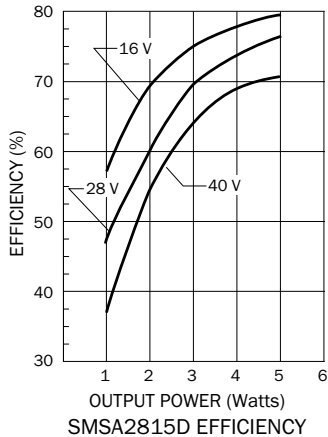


FIGURE 16

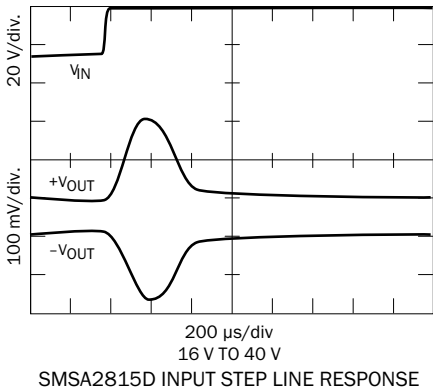


FIGURE 17

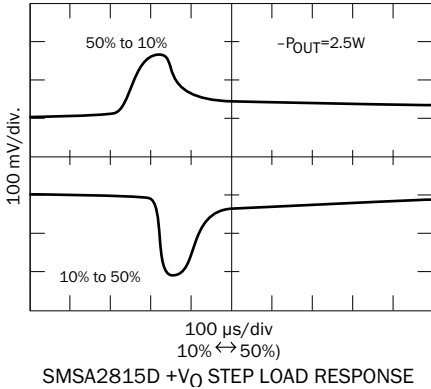


FIGURE 18

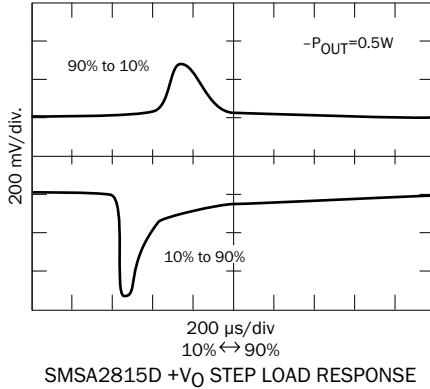


FIGURE 19

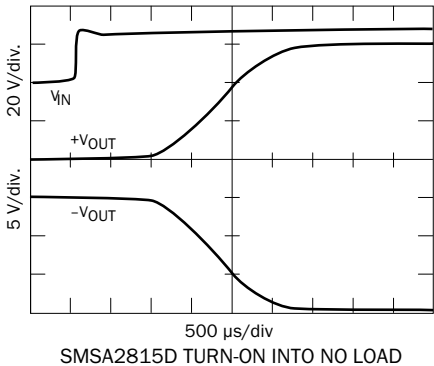


FIGURE 20

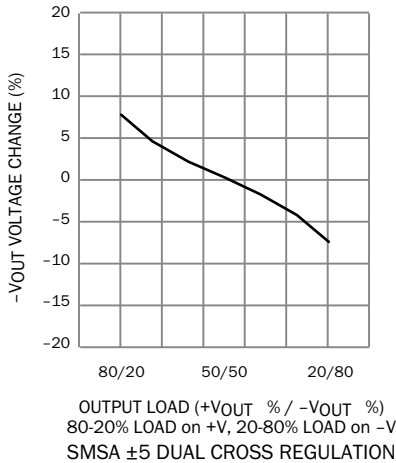


FIGURE 21

# SMSA Single and Dual DC-DC Converter

## 16 TO 40 VOLT INPUT - 5 WATT

TYPICAL PERFORMANCE PLOTS: 28 VIN, 25 °C CASE, 100% LOAD, UNLESS OTHERWISE SPECIFIED.  
These are examples for reference only and are not guaranteed specifications.

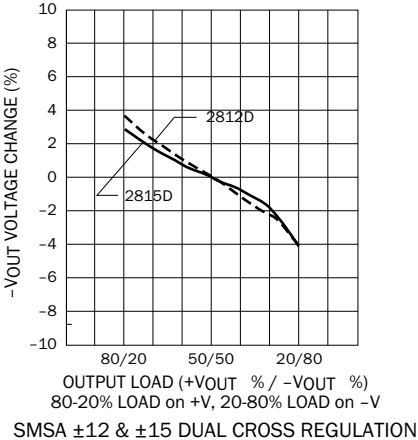


FIGURE 22

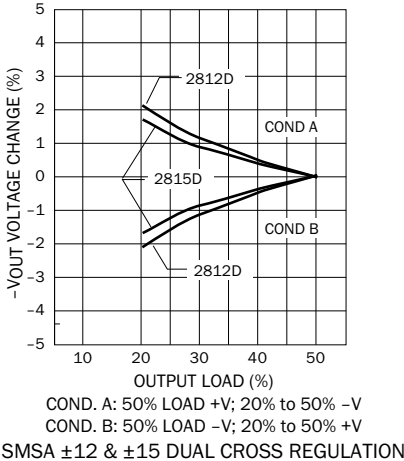
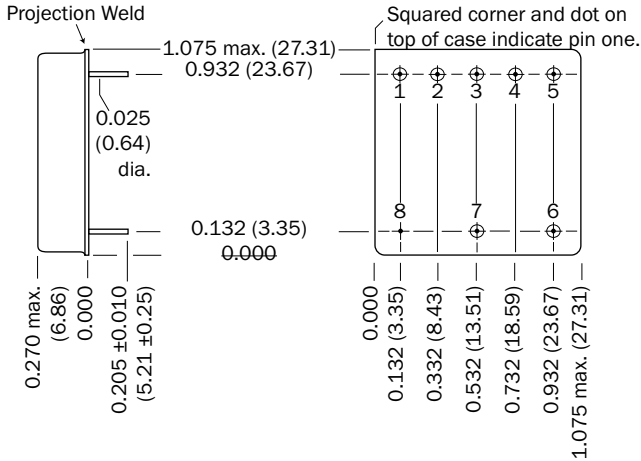


FIGURE 23

# SMSA Single and Dual DC-DC Converter

## 16 TO 40 VOLT INPUT - 5 WATT

BOTTOM VIEW CASE C1



Weight: 15 grams maximum

Case dimensions in inches (mm)  
Tolerance  $\pm 0.005$  (0.13) for three decimal places  
 $\pm 0.01$  (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 Cold Rolled Steel/Nickel
  - Pins #52 alloy, gold, compression glass seal
  - Gold plating of 50 - 150 microinches included in pin diameter
  - Seal hole:  $0.070 \pm 0.003$  (1.78  $\pm$  0.08)

Please refer to the numerical dimensions for accuracy.

FIGURE 24: CASE C1

# SMSA Single and Dual DC-DC Converter

## 16 TO 40 VOLT INPUT - 5 WATT

ELEMENT EVALUATION TABLES FOR QML PRODUCTS ARE IN "APP-009 QUALITY AND CERTIFICATION", APPENDIX A, IN COMPLIANCE WITH MIL-PRF-38534 REVISION L.  
( LINK [HTTPS://WWW.CRANEE.COM/QUALITY-ASSURANCE-MODULAR-POWER](https://www.cranee.com/quality-assurance-modular-power) )

### ENVIRONMENTAL SCREENING SPACE DC-DC CONVERTERS PROTOTYPE, CLASS H AND K

TEST PERFORMED	NON-QML <sup>1</sup>	QML <sup>2, 3</sup>	
	PROTOTYPE (/O) <sup>4</sup>	CLASS H (/H)	CLASS K (/K)
<b>Non-destruct wire bond pull, Method 2023</b>		■ <sup>5</sup>	■
<b>Pre-cap Inspection, Method 2017, 2032</b>	■	■	■
<b>Temperature Cycle (10 times)</b> Method 1010, Cond. C, -65°C to +150°C, ambient	■	■	■
<b>Constant Acceleration</b> Method 2001, 3000 g	■	■	■
<b>PIND, Test Method 2020, Cond. A</b>		■ <sup>5</sup>	■
<b>Pre burn-in test, Group A, Subgroups 1 and 4</b>	■	■ <sup>5</sup>	■
<b>Burn-in Method 1015, +125°C case, typical <sup>6</sup></b>			
96 hours	■		
160 hours		■	
2 x 160 hours (includes mid-BI test)			■
<b>Final Electrical Test, MIL-PRF-38534, Group A,</b>			
Subgroups 1 and 4: +25°C case	■		
Subgroups 1 through 6, -55°C, +25°C, +125°C case		■	■
<b>Hermeticity Test, Method 1014</b>			
Gross Leak, Cond. B <sub>2</sub> , Kr85			■
Gross Leak, Cond. C <sub>1</sub> , fluorocarbon	■	■	
Fine Leak, Cond. B <sub>1</sub> , Kr85			■
Fine Leak, Cond. A <sub>2</sub> , helium	■	■	
<b>Radiography, Method 2012</b>			■
<b>Post Radiography Electrical Test, +25°C case</b>			■ <sup>5</sup>
<b>Final visual inspection</b>			
Method 2009 of MIL-STD-883		■	■
Magnification 1X <sup>7</sup>	■		

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. Class H or K QML products that have no SMD number are marked "CHP, CHL, CHR, CKP, CKL or CKR" per MIL-PRF-38534, Table III instead of "QML".
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.
7. Visual inspection is performed per an internal document. Product may contain cosmetic irregularities such as dents, dings, scratches, etc. that do not affect form, fit or function.

TABLE 9: ENVIRONMENTAL SCREENING SPACE DC-DC CONVERTERS PROTOTYPE, CLASS H AND K

# SMSA Single and Dual DC-DC Converter

**16 TO 40 VOLT INPUT - 5 WATT**

## SPACE RADIATION HARDNESS ASSURANCE DC-DC CONVERTERS CLASS H AND K, RHA <sup>1</sup> P, L AND R

QUALIFICATION PER MIL-STD	QML <sup>2</sup>					
	CLASS H			CLASS K		
	/HP	/HL	/HR	/KP	/KL	/KR
RHA P: 30 krad(Si) total dose <sup>3, 4</sup>	■			■		
RHA L: 50 krad(Si) total dose <sup>3, 4</sup>		■			■	
RHA R: 100 krad(Si) total dose <sup>3, 4</sup>			■			■
SEE, LET 86 MeV cm <sup>2</sup> /mg <sup>5</sup>	■	■	■	■	■	■

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

- Notes
1. DLA has approved the RHA plan for Interpoint power products. Our SMD products with RHA “P”, “L” or “R” code meet DLA requirements.
  2. Class H or K QML products that have no SMD number are marked “CHP, CHL, CHR, CKP, CKL or CKR” per MIL-PRF-38534, Table III instead of “QML”.
  3. 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.
  4. Representative devices were initially High Dose Rate (HDR) tested using condition A of method 1019 of MIL-STD 883 to ensure RHA designator levels. Representative devices have also been Low Dose Rate (LDR) tested using condition D of method 1019 of MIL-STD-883 to the RHA designator levels. Representative devices will also be re-tested after design or process changes that can affect RHA response of this device.
  5. Single event testing was performed on a converter to 86 MeV-cm<sup>2</sup>/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 86 MeV-cm<sup>2</sup>/mg.

TABLE 10: SPACE RADIATION HARDNESS ASSURANCE DC-DC CONVERTERS CLASS H AND K, RHA P, L AND R

