SMFL Single and Dual DC-DC Converters

16 TO 40 VOLT INPUT – 45 TO 65 WATT

FEATURES

- Radiation tolerant space DC-DC converter
  - Single event effects (SEE) LET performance to 86 MeV cm^2/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)
- Parallel up to 3 converters—maximum recommended power is 80% of the total available power.
- 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 up to 80 volts for 50 ms
  - Converter will shut down at an input voltage above approximately 45 volts
- Fully isolated, magnetic feedback
- Fixed high switching frequency
- Remote sense and output trim on single output models
- Primary and secondary inhibit function
- Synchronization input and output
- Indefinite short circuit protection
- High power density with up to 85% typical efficiency

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

DESCRIPTION

The Interpoint® SMFL Series™ of 28 volt DC-DC converters offers up to 65 watts of power in a radiation hardened design. The low profile SMFL 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 full output power over is available over the temperature range of -55°C to +125°C with a 28 volt nominal input. On dual output models, up to 70% of the rated output power can be drawn from either the positive or negative outputs. The welded, hermetically sealed package is only 3.005 x 1.505 x 0.400 inches.

SCREENING

SMFL converters offer screening options to space prototype (0), Class H or K and 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^2/mg.

DESIGN FEATURES

The SMFL Series converters are switching regulators that use a quasi-square wave, single ended forward converter design with a constant switching frequency of 600 kHz.

Isolation between input and output circuits is provided with a transformer in the forward path and wide bandwidth magnetic coupling in the feedback control loop. The SMFL Series uses a unique dual loop feedback technique that controls output current with an inner feedback loop and output voltage with a cascaded voltage mode feedback loop.

The additional secondary current mode feedback loop improves transient response in a manner similar to primary current mode control and allows for ease of paralleling.

Tight load regulation is achieved through a wide-bandwidth magnetic feedback circuit.

INHIBIT

The SMFL Series converters have two inhibit terminals (Inhibit 1 and Inhibit 2) that can be used to disable power conversion, resulting in a very low quiescent input current. See Table 5 on page 6 for specifications.

Crane Aerospace & Electronics
Power Solutions – Interpoint Products
16706 13th Ave W, Lynnwood WA 98037
+1 425.882.3100 • power@craneae.com
www.craneae.com/interpoint

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SYNC

Converters may be synced to an external clock (525 to 675 kHz) or to one another by using the sync in or out pins. See Table 5 on page 6 for specifications.

SENSE AND TRIM

Single output models provide sense to maintain voltage at the load. The converters output voltage can also be trimmed up. See Figure 1.

CURRENT SHARING AND PARALLEL OPERATION

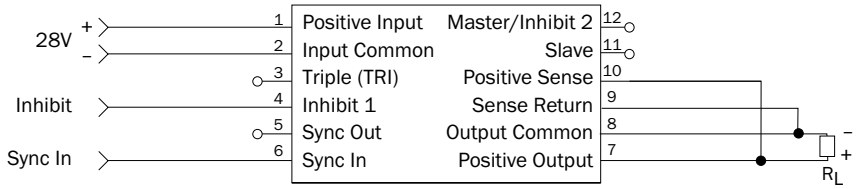
For increased power parallel up to 3 converters. The maximum recommended power is 80% of the total available power. Multiple SMFL converters may be used in parallel to drive a common load. Only single output models with Sense and Sense Return can be used in the share mode. In this mode of operation the load current is shared by two or three SMFL converters.

In current sharing mode, one SMFL converter is designated as a master. The Slave pin (pin 11) of the master is left unconnected and the Master/Inhibit 2 pin (pin 12) of the master is connected to the Slave pin (pin 11) of the slave units.

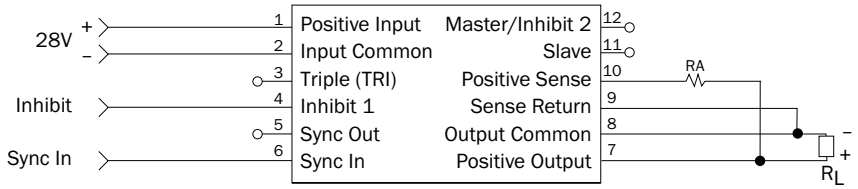
The units designated as slaves have the Master/Inhibit 2 pin (pin 12) connected to the Sense Return pin (pin 9) of the master unit. Figure 2 on page 3 shows the typical setup for two or three units in parallel.

A second slave unit may be placed in parallel with a master and slave; this requires the Triple pin (pin 3) of the master unit to be connected to the Sense Return pins (pin 9) shown in Figure 2 on page 3.

In current sharing mode, the converters function as a current source. For this reason it is important that their outputs be connected to the common ground at all times to prevent an excessively high voltage at their outputs.



REMOTE SENSE CONNECTION



OUTPUT VOLTAGE ADJUST CONNECTION

V_{OUT} INCREASE	R_A (Ω)			
VOLTS	3.3 V	5 V	12 V	15 V
0.1	66	77	27	21
0.2	131	153	55	43
0.3	196	230	82	64
0.4	262	307	109	86
0.5	349	396	139	109

Notes
1. When using remote sense for voltage compensation or when using remote sense for trim, the output will drift over temperature. Contact Applications Engineering for more information powerapps@craneae.com.
2. Do not exceed the maximum rated power or current.

FIGURE 1: SENSE CONNECTIONS AND TRIM TABLE – SINGLE OUTPUT MODELS

SMFL Single and Dual DC-DC Converters

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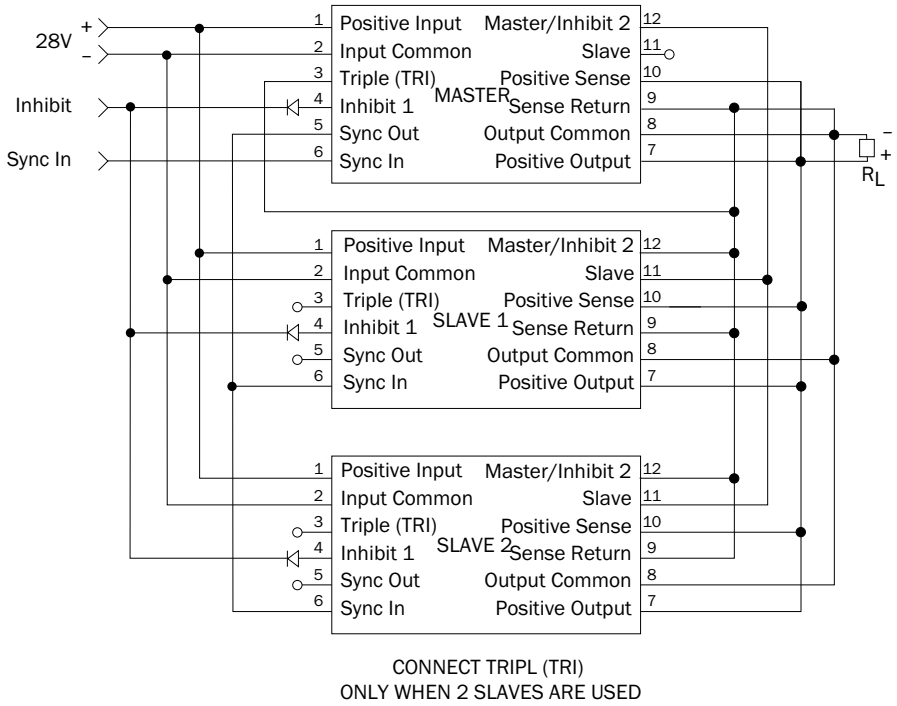

CONNECT TRIPL (TRI)
ONLY WHEN 2 SLAVES ARE USED

Notes
1. No one converter may carry more than its maximum rated current.
2. Individual converter operation, load and layout may affect the actual current shared. Contact Applications Engineering for more information powerapps@craneae.com.
3. When paralleling SMFLs a diode is required at the input of each inhibit pin as SMFLs do not have an internal diode on the inhibit pin.

FIGURE 2: PARALLEL CONNECTIONS – SINGLE OUTPUT MODELS

SMFL Single and Dual DC-DC Converters

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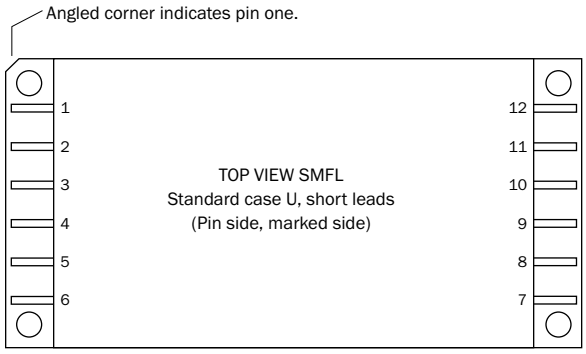
PIN OUT		
Pin	**Single Output**	**Dual Output**
1	Positive Input	Positive Input
2	Input Common	Input Common
3	Triple (TRI)	Triple (TRI)
4	Inhibit 1 (INH1)	Inhibit 1 (INH1)
5	Sync Out	Sync Out
6	Sync In	Sync In
7	Positive Output	Positive Output
8	Output Common	Output Common
9	Sense Return	Negative Output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

TABLE 1: PIN OUT

PINS NOT IN USE	
Triple (TRI)	Leave unconnected
Inhibit 1 (INH1)	Leave unconnected
Sync Out	Leave unconnected
Sync In	Connect to Input Common
Sense Return	Connect to appropriate outputs
Positive Sense	Connect to appropriate outputs
Slave	Leave unconnected
Master/Inhibit 2 (MSTR/INH2)	Leave unconnected

TABLE 2: PINS NOT IN USE



See Figure 16 on page 12 for dimensions for case U.

FIGURE 3: PIN OUT

SMFL Single and Dual DC-DC Converters

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MODEL NUMBERING KEY

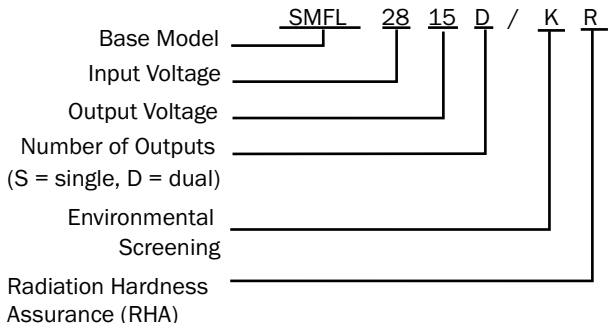

FIGURE 4: MODEL NUMBERING KEY

SMD NUMBERS

STANDARD MICROCIRCUIT DRAWING (SMD)	SMFL SERIES SIMILAR PART
5962R0621302KXC	SMFL283R3S/KR
5962R9316302KXC	SMFL2805S/KR
5962R9316202KXC	SMFL2812S/KR
5962R9316102KXC	SMFL2815S/KR
5962R9319102KXC	SMFL2805D/KR
5962R9319202KXC	SMFL2812D/KR
5962R9319302KXC	SMFL2815D/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

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 [1]	Number of Outputs [2]	Case Option	Screening [3]	RHA [4]
OPTIONS	SMFL28	3R3, 05, 12, 15	S	(U, leave blank)	O	O
		05, 12, 15	D		H	P
					K	L
						R
FILL IN FOR MODEL # [5]	SMFL28	_____	_____	_____	/ _____	_____

Notes
1. Output Voltage: An R indicates a decimal point. 3R3 is 3.3 volts out. The value of 3R3 is 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 5 and Table 9 on page 13 for more information..
4. RHA: 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 10 on page 14 for more information.
5. If ordering by model number add a "-Q" to request solder dipped leads (SMFL2805S/KR-Q).

TABLE 4: MODEL NUMBER OPTIONS

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TABLE 5: OPERATING CONDITIONS, ALL MODELS, 25°C CASE, 28 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	—	+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 3B	>8000			V
ISOLATION: INPUT TO OUTPUT, INPUT TO CASE, OUTPUT TO CASE [3]	@ 500 VDC AT 25°C	100	—	—	Megohms
INPUT TO OUTPUT CAPACITANCE [1]		—	150	—	pF
CURRENT LIMIT [4]	% OF FULL LOAD	—	125	—	%
UNDERVOLTAGE LOCKOUT [1]	RISING V_{IN} (TURN ON)	14.1	—	15.8	V
-55°C TO +125°C	FALLING V_{IN} (TURN OFF)	11.6	—	14.0	
AUDIO REJECTION [1]		—	50	—	dB
SWITCHING FREQUENCY	-55°C TO +125°C	525	—	675	kHz
SYNCHRONIZATION IN	INPUT FREQUENCY	525	—	675	kHz
-55°C TO +125°C	DUTY CYCLE [1]	40	—	60	%
	ACTIVE LOW	—	—	0.8	V
	ACTIVE HIGH [1]	4.5	—	5.0	
	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)	INHIBIT PIN PULLED LOW	—	—	0.8	V
Do not apply a voltage to the inhibit pin. [5]	INHIBIT PIN SOURCE CURRENT [1]	—	—	10	mA
	REFERENCED TO	INPUT COMMON			
INHIBIT 1 ACTIVE HIGH (OUTPUT ENABLED)	INHIBIT PIN CONDITION	OPEN COLLECTOR OR UNCONNECTED			
Do not apply a voltage to the inhibit pin. [5]	OPEN INHIBIT PIN VOLTAGE [1]	9	—	12	V
INHIBIT 2 ACTIVE LOW (OUTPUT DISABLED)	INHIBIT PIN PULLED LOW	—	—	0.5	V
Do not apply a voltage to the inhibit pin. [5]	INHIBIT PIN SOURCE CURRENT [1]	—	—	5	mA
	REFERENCED TO	OUTPUT COMMON			
INHIBIT 2 ACTIVE HIGH (OUTPUT ENABLED)	INHIBIT PIN CONDITION	OPEN COLLECTOR OR UNCONNECTED			
Do not apply a voltage to the inhibit pin. [5]	OPEN INHIBIT PIN VOLTAGE [1]	—	—	9	V

For mean time between failures (MTBF) contact Applications Engineering: powerapps@craneae.com or +1 425.882.3100

Notes
1. Guaranteed by characterization test and/or analysis. Not a production test.
2. Passes 8000 volts.
3. Isolation is tested with the all input pins (referenced to input common) tied together, and all output pins (referenced to output common) tied together. They are tested for isolation input to output, input to case and output to case. Discharge the pins after each test.
4. 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.
5. 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.

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

SINGLE OUTPUT MODELS		SMFL283R3S			SMFL2805S			UNITS
PARAMETER	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	
OUTPUT VOLTAGE		3.21	3.30	3.39	4.87	5.00	5.13	V
OUTPUT CURRENT	V_{IN} = 16 TO 40 V	0	—	12.12	0	—	10	A
OUTPUT POWER	V_{IN} = 16 TO 40 V	0	—	40	0	—	50	W
OUTPUT RIPPLE	T_C = 25°C	—	10	35	—	15	35	mV p-p
10 kHz - 2 MHz	T_C = -55°C TO +125°C	—	10	50	—	30	50	
LINE REGULATION	V_{IN} = 16 TO 40 V	—	0	20	—	0	20	mV
LOAD REGULATION	NO LOAD TO FULL	—	—	40	—	—	20	mV
INPUT VOLTAGE	CONTINUOUS	16	28	40	16	28	40	V
	TRANSIENT 50 ms [1, 2]	—	—	80	—	—	80	
INPUT CURRENT	NO LOAD	—	70	100	—	70	120	mA
	INHIBITED – INH1	—	9	14	—	9	14	
	INHIBITED – INH2	—	35	70	—	35	70	
INPUT RIPPLE	10 kHz - 10 MHz	—	30	50	—	30	50	mA p-p
EFFICIENCY [3]	T_C = 25°C	71	—	—	75	78	—	%
	T_C = -55°C TO +125°C	69	—	—	73	—	—	
LOAD FAULT [4]	POWER DISSIPATION	—	12.5	16	—	12.5	18	W
SHORT CIRCUIT	RECOVERY [1]		1.5	6		1.5	4	ms
STEP LOAD RESPONSE [4, 5]	TRANSIENT	—	±200	±300	—	±250	±350	mV pk
50% - 100% - 50%	RECOVERY [1]	—	1.5	3.0	—	1.5	3.0	ms
STEP LINE RESPONSE [1, 4, 6]	TRANSIENT	—	±250	±300	—	±250	±300	mV pk
16 - 40 -16 V	RECOVERY	—	200	300	—	200	300	µs
START-UP [4, 7]	DELAY	—	3.5	10	—	3.5	6	ms
	OVERSHOOT [1]	—	—	25	—	—	25	mV pk
CAPACITIVE LOAD [1, 8]	T_C = 25°C	—	—	1000	—	—	1000	µF

Notes
1. Guaranteed by characterization test and/or analysis. Not a production test.
2. Converter will shut down above approximately 45 volts but will be undamaged and will restart when voltage drops into normal range.
3. "00" product may be 2% lower.
4. Recovery time is measured from application of the transient to point at which Vout is within 1% of final value.
5. Step load test is performed at 10 microseconds typical.
6. Step line test is performed at 100 microseconds ± 20 microseconds.
7. Tested on release from inhibit.
8. No affect on dc performance.

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

SINGLE OUTPUT MODELS		SMFL2812S			SMFL2815S			UNITS
PARAMETER	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	
OUTPUT VOLTAGE		11.76	12.00	12.24	14.55	15.00	15.45	V
OUTPUT CURRENT	V_{IN} = 16 TO 40 V	0	—	5	0	—	4.33	A
OUTPUT POWER	V_{IN} = 16 TO 40 V	0	—	60	0	—	65	W
OUTPUT RIPPLE	T_C = 25°C	—	0	75	—	30	85	mV p-p
10 kHz - 2 MHz	T_C = -55°C TO +125°C	—	45	100	—	45	110	
LINE REGULATION	V_{IN} = 16 TO 40 V	—	0	20	—	0	20	mV
LOAD REGULATION	NO LOAD TO FULL	—	—	20	—	—	20	mV
INPUT VOLTAGE	CONTINUOUS	16	28	40	16	28	40	V
	TRANSIENT 50 ms [1, 2]	—	—	80	—	—	80	
INPUT CURRENT	NO LOAD	—	50	100	—	50	100	mA
	INHIBITED – INH1	—	9	14	—	9	14	
	INHIBITED – INH2	—	35	70	—	35	70	
INPUT RIPPLE	10 kHz - 10 MHz	—	30	50	—	30	50	mA p-p
EFFICIENCY [3]	T_C = 25°C	81	84	—	82	85	—	%
	T_C = -55°C TO +125°C	79	—	—	80	—	—	
LOAD FAULT [4]	POWER DISSIPATION	—	10	16	—	10	16	W
SHORT CIRCUIT	RECOVERY [1]		1.5	4		1.5	4	ms
STEP LOAD RESPONSE [4, 5]	TRANSIENT	—	±450	±600	—	±500	±600	mV pk
50% - 100% - 50%	RECOVERY [1]	—	1.5	3.0	—	1.5	3.0	ms
STEP LINE RESPONSE [1, 4, 6]	TRANSIENT	—	±250	±400	—	±250	±500	mV pk
16 - 40 -16 V	RECOVERY	—	200	300	—	200	300	µs
START-UP [4, 7]	DELAY	—	3.5	6	—	3.5	6	ms
	OVERSHOOT [1]	—	—	50	—	—	50	mV pk
CAPACITIVE LOAD [1, 8]	T_C = 25°C	—	—	1000	—	—	1000	µF

Notes
1. Guaranteed by characterization test and/or analysis. Not a production test.
2. Converter will shut down above approximately 45 volts but will be undamaged and will restart when voltage drops into normal range.
3. "OO" product may be 2% lower.
4. Recovery time is measured from application of the transient to point at which Vout is within 1% of final value.
5. Step load test is performed at 10 microseconds typical.
6. Step line test is performed at 100 microseconds ± 20 microseconds.
7. Tested on release from inhibit.
8. No affect on dc performance.

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

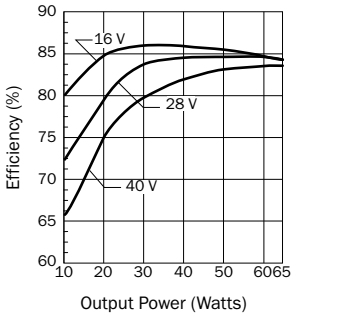
DUAL OUTPUT MODELS		SMFL2805D			SMFL2812D			SMFL2815D			UNITS
PARAMETER	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
OUTPUT VOLTAGE	$+V_{OUT}$	4.85	5.00	5.15	11.64	12.00	12.36	14.55	15.00	15.45	V
	$-V_{OUT}$	4.82	5.00	5.18	11.58	12.00	12.42	14.47	15.00	15.53	
OUTPUT CURRENT [2]	EITHER OUTPUT	0	±5	7	0	±2.5	3.5	0	±2.17	3.03	A
V_{IN} = 16 TO 40 V	TOTAL	0	–	10	0	–	5	0	–	4.33	
OUTPUT POWER [2]	EITHER OUTPUT	0	±25	35	0	±30	42	0	±32.5	45.5	W
V_{IN} = 16 TO 40 V	TOTAL	0	–	50	0	–	60	0	–	65	
OUTPUT RIPPLE	T_C = 25°C	–	–	50	–	–	80	–	–	100	mV p-p
10 kHz - 2 MHz ± V_{OUT}	T_C = -55°C TO +125°C	–	50	100	–	50	120	–	50	150	
LINE REGULATION	$+V_{OUT}$	–	0	50	–	0	50	–	0	50	mV
V_{IN} = 16 TO 40 V	$-V_{OUT}$	–	25	100	–	25	100	–	25	100	
LOAD REGULATION	$+V_{OUT}$	–	0	50	–	0	50	–	0	50	mV
NO LOAD TO FULL	$-V_{OUT}$	–	25	100	–	50	120	–	50	150	
CROSS REGULATION	SEE NOTE 3	–	–	400	–	–	480	–	–	600	mV
T_C = 25°C	SEE NOTE 4	–	–	300	–	–	480	–	–	600	
INPUT VOLTAGE	$+V_{OUT}$	16	28	40	16	28	40	16	28	40	V
	TRANSIENT 50 ms [1, 5]	–	–	80	–	–	80	–	–	80	
INPUT CURRENT	NO LOAD	–	50	120	–	50	100	–	50	100	mA
	INHIBITED–INH1	–	9	14	–	9	14	–	9	14	
	INHIBITED–INH2	–	35	70	–	35	70	–	35	70	
INPUT RIPPLE CURRENT	10 kHz - 10 MHz	–	30	50	–	30	50	–	30	80	mA p-p
EFFICIENCY	T_C = 25°C	75	78	–	81	84	–	82	85	–	%
BALANCED LOAD	T_C = -55°C TO +125°C	73	–	–	79	–	–	80	–	–	
LOAD FAULT [6]	POWER DISSIPATION	–	12.5	18	–	10	16	–	10	16	W
	RECOVERY [1]	–	1.5	4.0	–	1.5	4.0	–	1.5	4.0	ms
STEP LOAD RESPONSE [6, 7]	TRANSIENT	–	±250	±350	–	±450	±600	–	±500	±600	mV pk
50% - 100% - 50% ± V_{OUT}	RECOVERY [1]	–	1.5	3.0	3.0	1.5	3.0		1.5	3.0	ms
STEP LINE RESPONSE [1, 6, 8]	TRANSIENT	–	±250	±300	–	±250	±400	–	±250	±500	mV pk
16 - 40 -16 V ± V_{OUT}	RECOVERY	–	200	300	–	200	300	–	200	300	µs
START-UP [6, 9]	DELAY	–	3.5	6	–	3.5	6	–	3.5	6	ms
	OVERSHOOT [1]	–	–	25	–	–	50	–	–	50	mV pk
CAPACITIVE LOAD [1, 10, 11]	T_C = 25°C	–	–	500	–	–	500	–	–	500	µF

Notes
1. Guaranteed by characterization test and/or analysis. Not a production test.
2. Up to 70% of the total output power/current is available from either output providing the opposite output is simultaneously carrying 30% of the total power/current.
3. Effect on negative Vout from 50%/50% loads to 70%/30% or 30%/70% loads.
4. Effect on negative Vout from 50%/50% loads to 50% then 10% load on negative Vout.
5. Converter will shut down above approximately 45 volts but will be undamaged and will restart when voltage drops into normal range.
6. Recovery time is measured from application of the transient to point at which Vout is within 1% of 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.
10. No affect on dc performance.
11. Applies to each output.

SMFL Single and Dual DC-DC Converters

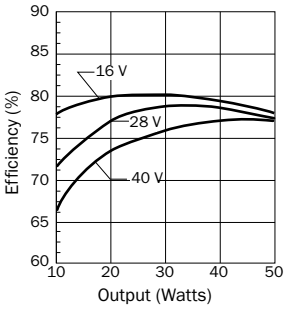
16 TO 40 VOLT INPUT – 45 TO 65 WATT

Typical Performance Plots: 28 Vin, 25°C Case, 100% load, unless otherwise specified.
These are examples for reference only and are not guaranteed specifications.



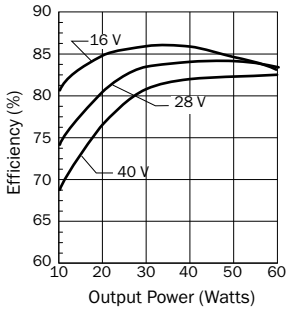
SMFL2815S & SMFL2815D Efficiency

FIGURE 5



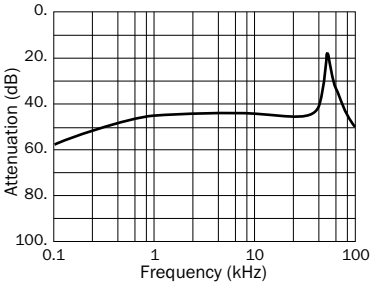
SMFL2805S & SMFL2805D Efficiency

FIGURE 6



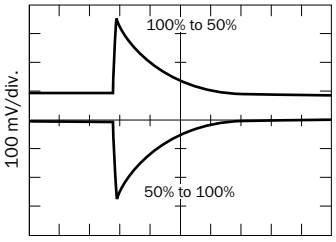
SMFL2812S & SMFL2812D Efficiency

FIGURE 7



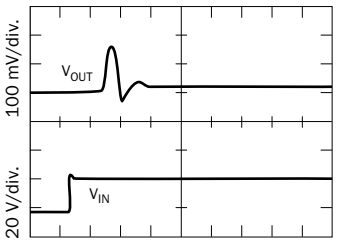
SMFL Series Audio Rejection

FIGURE 8



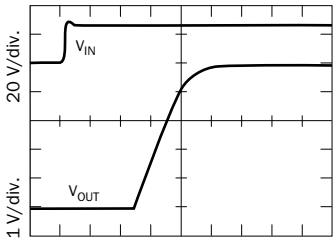
SMFL2805S Step Load Response

FIGURE 9



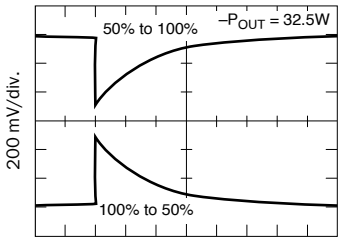
SMFL2805S Step Line Response

FIGURE 10



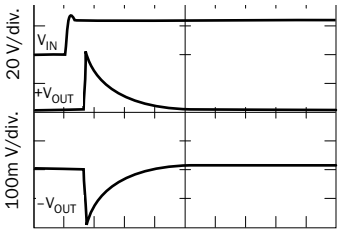
SMFL2805S Turn On Response

FIGURE 11



SMFL2815D Step Load Response

FIGURE 12



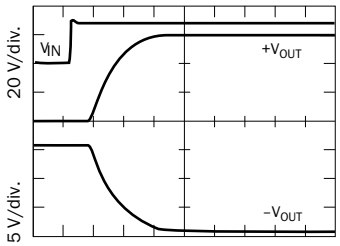
SMFL2815D Step Line Response

FIGURE 13

SMFL Single and Dual DC-DC Converters

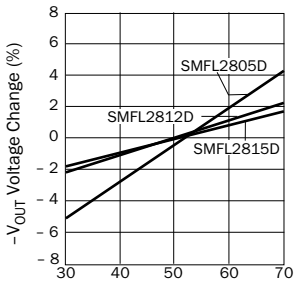
16 TO 40 VOLT INPUT – 45 TO 65 WATT

Typical Performance Plots: 28 Vin, 25°C Case, 100% load, unless otherwise specified.
These are examples for reference only and are not guaranteed specifications.



SMFL2815D Turn On Response

FIGURE 14



-V_{OUT} with shift in load balance
Cross Regulation

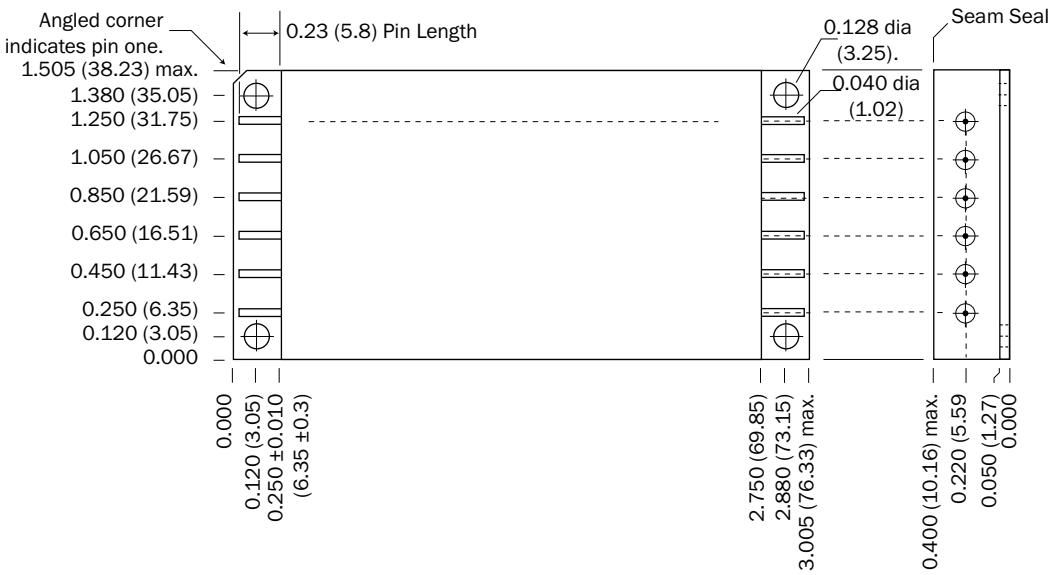
FIGURE 15

SMFL Single and Dual DC-DC Converters

16 TO 40 VOLT INPUT – 45 TO 65 WATT

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 16: CASE U

SMFL Single and Dual DC-DC Converters

16 TO 40 VOLT INPUT – 45 TO 65 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.CRANEAE.COM/QUALITY-ASSURANCE-MODULAR-POWER)

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

	NON-QML [1]	QML [2, 3]	
TEST PERFORMED	**PROTOTYPE (/O) [4]**	**CLASS H (/H)**	**CLASS K (/K)**
Non-destruct wire bond pull, Method 2023		■ [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]	■
Pre burn-in test, Group A, Subgroups 1 and 4	■	■ [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]
Final visual inspection			
Method 2009 of MIL-STD-883		■	■
Magnification 1X [7]	■		

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

SMFL Single and Dual DC-DC Converters

16 TO 40 VOLT INPUT – 45 TO 65 WATT

Space Radiation Hardness Assurance DC-DC Converters Class H and K, RHA [1] P, L and R

	QML [2]					
	Class H			Class K		
Qualification Per MIL-STD	/HP	/HL	/HR	/KP	/KL	/KR
RHA P: 30 krad(Si) total dose [3, 4]	■			■		
RHA L: 50 krad(Si) total dose [3, 4]		■			■	
RHA R: 100 krad(Si) total dose [3, 4]			■			■
SEE, LET 86 MeV cm^2/mg [5]	■	■	■	■	■	■

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^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 86 MeV-cm^2/mg.

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