

SLH Single and Dual DC/DC Converters

28 VOLT INPUT – 1.5 WATT – PENDING REVISION C RELEASE

FEATURES

Small size, 0.8 inches² (5.16 cm²)

- Operating temperature -55° to +125°C
- Qualified to MIL-PRF-38534 Class H and K
- Radiation hardness assurance (RHA) to level R 100 kRad(Si)
- Input voltage range 16 to 40 VDC
- Fully isolated, magnetic feedback
- Inhibit function
- Indefinite short circuit protection
- High power density, 88% efficiency



MODELS VDC OUTPUT	
SINGLES	DUALS
5	±5
12	±12
15	±15

DESCRIPTION

With a miniature footprint of just 0.8 square inches, the SLH Series™ of 28 V DC/DC converters delivers 1.5 watts of output power while saving significant board area. The wide input voltage range of 16 to 40 VDC accepts the varying voltages of space, military, or aerospace bus power and tightly regulates output voltages to protect downstream components. Single output models feature outputs of 5, 12, or 15 volts, and dual output models feature outputs of ±5, ±12 and ±15 volts.

SCREENING

SLH converters offer the following screening options: Space Prototype (O), Class H, or Class K. Radiation tolerant to Radiation Hardness Assurance (RHA) levels of “-” (O) or “R”, per MIL-STD-38534. 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”. See “Class H and K, QML Screening” tables for more information.

CONVERTER DESIGN

SLH Series DC/DC converters incorporate a flyback topology with a variable switching frequency. Feedback provides output voltage regulation. Output voltage is magnetically fed back to the input side of the PWM to regulate output voltage.

Up to 80% of the load of the dual output models may be on one output providing that the other output carries a minimum of 20% of the total load. The dual models can be used as a single output voltage by connecting the load between positive and negative outputs, leaving the common unconnected resulting in double the output voltage. (for example, SLH2805D can be used as a 10 VDC output.)

When used with Interpoint's STF28-461 filter, the combination will meet the requirements of MIL-STD-461C, CE03.

INHIBIT FUNCTION

The SLH Series incorporates an inhibit terminal that can be used to disable internal switching. The converter is inhibited when an active low (≤ 0.5 V) signal is applied to the inhibit pin (pin 7). In the inhibit mode the inhibit pin sources up to 2 mA maximum. The converter resumes normal operation when an open circuit is applied to the inhibit pin. The open circuit voltage of the inhibit is 7 to 8 volts. Do not apply an external pull-up to the converter.

PROTECTION FEATURES

All models include a soft-start function to prevent large current draw and minimize overshoot. The converters provide short circuit protection (by restricting the current) and output overload protection.

CONVENIENT PACKAGING

The SLH Series converters are packaged in hermetically sealed metal cases which provide EMI/RFI shielding.

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OPERATING CONDITIONS AND CHARACTERISTICS

Input Voltage Range

- 16 to 40 VDC continuous
- 50 V for 50 msec transient

Output Power

- 1.5 W

Lead Soldering Temperature (10 sec per lead)

- 300°C

Storage Temperature Range (Case)

- -65°C to +150°C

Capacitive Load

- Single output models 100 μ F
- Dual output models 100 μ F

Case Operating Temperature (Tc)

- -55°C to +125°C full power
- -55°C to +135°C absolute

Output Voltage Temperature Coefficient

- 100 ppm/°C typical

Input to Output Capacitance

- 100 to 170 pF typical

Isolation

- 100 megohm minimum at 500 VDC
- Any pin to case, except case pin

Conversion Frequency (kHz), 28 Vin, full load

- 25°C, 280 typ
- -55°C to +125°C; 220 min, 320 max

Derating Output Power/Current (Tc)

- Linearly from 100% at 125°C to 0% at 135°C

INHIBIT

- Active low (output disabled)
 - INH referenced to input common
 - Active low 0.5 V max
 - Inhibit pin current < 2mA
- Active high (output enabled)
 - Open collector or unconnected
 - Pin voltage 7 to 8 volts, typical (open circuit)
 - Do not apply external pull-up

MECHANICAL AND ENVIRONMENTAL

Size (maximum)

- 0.980 x 0.805 x 0.270 inches (24.89 x 20.45 x 6.86 mm)
- See case A2 for dimensions.

Weight (maximum)

- 12 grams

Screening

Space Prototype (O), Class H, or Class K Radiation tolerant to Radiation Hardness Assurance (RHA) levels of “-” (O) or “R”, per MIL-STD-38534. 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”.

See “Class H and K, QML Screening” tables, page 10. Available configurations: OO, HR, KR

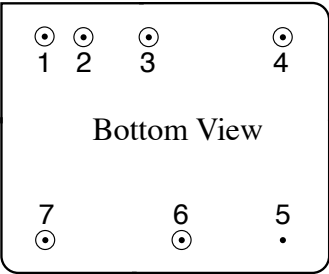
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28 VOLT INPUT – 1.5 WATT – PENDING REVISION C RELEASE

PIN OUT

Pin	Single Output	Dual Output
1	Positive Input	Positive Input
2	Input Common	Input Common
3	Positive Output	Positive Output
4	Output Common	Output Common
5	Case Ground	Case Ground
6	No connection	Negative Output
7	Inhibit	Inhibit

Squared corner and dot on top of cover indicate pin one.



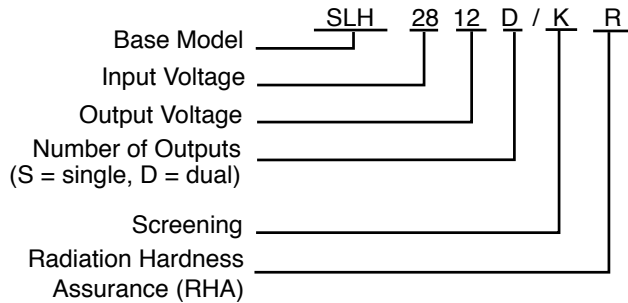
See case A2 for dimensions.

FIGURE 1: PIN OUT

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MODEL NUMBERING KEY



SMD NUMBERS

STANDARD MICROCIRCUIT DRAWING (SMD)	SLH SIMILAR PART
5962R0052601KXC	SLH2805S/KR
5962R0052701KXC	SLH2812S/KR
5962R0052801KXC	SLH2815S/KR
5962R0250401KXC	SLH2805D/KR
5962R9955601KXC	SLH2812D/KR
5962R9852901KXC	SLH2815D/KR

The SMD number shown is for Class K screening and Radiation Hardness Assurance (RHA) level R. See the SMD for the numbers for other screening and radiation levels. For exact specifications for an SMD product, refer to the SMD drawing. Call your Interpoint representative for status on the SMTR SMD releases which are "in process." SMDs can be downloaded from: <http://www.dscc.dla.mil/programs/smcr>

MODEL SELECTION

ENTER ONE SELECTION FROM EACH CATEGORY

SLH28 _____ / _____					
BASE MODEL	V _{OUT} VALUE	NUMBER OF OUTPUTS ¹	CASE OPTION ²	SCREENING ³	RHA ⁴
	5	S	NO CASE OPTIONS FOR SLH	O	O
	12	D		H	R
	15			K	

Notes:

1. S is a single output and D is a dual output
2. There are not case options for the SLH. Only the standard case is available.
3. A screening level of O is a Space Prototype and is only used with RHA O.
4. 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. For more information see page 10.

SLH Single and Dual DC/DC Converters

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Electrical Characteristics: -55° to + 125°C Tc, 28 VDC Vin, 100% load, unless otherwise specified.

SINGLE OUTPUT MODELS		SLH2805S			SLH2812S			SLH2815S			UNITS
PARAMETER	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
OUTPUT VOLTAGE ²	25°C	4.95	5.00	5.05	11.88	12.00	12.12	14.85	15.00	15.15	VDC
	-55 TO +125° C	4.80	—	5.20	11.52	—	12.48	14.40	—	15.60	
OUTPUT CURRENT	VIN = 16 TO 40 VDC	—	—	300	—	—	125	—	—	100	mA
OUTPUT POWER	VIN = 16 TO 40 VDC	—	—	1.5	—	—	1.5	—	—	1.5	W
OUTPUT RIPPLE	25°C, 10 kHz TO 2 MHz	—	65	150	—	35	200	—	60	200	mV p-p
	-55 TO +125° C, 10 kHz TO 2 MHz	—	—	250	—	—	300	—	—	300	
LINE REGULATION	VIN = 16 TO 40 VDC	—	115	300	—	60	400	—	60	650	mV
LOAD REGULATION	LOAD 10% TO 100%	—	440	700	—	380	700	—	410	700	mV
INPUT VOLTAGE	NO LOAD TO FULL CONTINUOUS	16	28	40	16	28	40	16	28	40	VDC
	TRANSIENT 50 ms ¹	—	—	50	—	—	50	—	—	50	V
INPUT CURRENT	NO LOAD	—	2.9	17	—	2.3	17	—	2.4	17	mA
	INHIBITED	—	1.3	5	—	1.3	5	—	1.3	5	
INPUT RIPPLE CURRENT ³	10 kHz - 10 MHz	—	85	250	—	75	300	—	60	300	mA p-p
EFFICIENCY	25°C, FULL LOAD	72	79	—	80	87	—	80	88	—	%
	-55 TO +125° C, FULL LOAD	69	—	—	69	—	—	69	—	—	
LOAD FAULT ^{4, 5}	SHORT CIRCUIT POWER DISSIPATION	—	0.4	1.5	—	0.3	1.2	—	0.3	1.2	W
	RECOVERY ^{1, 8}	—	—	30	—	—	30	—	—	30	ms
STEP LOAD RESPONSE ^{1, 5}	50% - 100% - 50% TRANSIENT	—	±250	±400	—	±220	±700	—	±220	±700	mV pk
	RECOVERY	—	—	400	—	—	400	—	—	400	μs
STEP LINE RESPONSE ⁶ 16 - 40 -16 VDC	TRANSIENT	—	—	±600	—	—	±600	—	—	±600	mV pk
	RECOVERY ^{1, 8}	—	—	500	—	—	500	—	—	500	μs
START-UP ⁷	DELAY	—	1	20	—	1	20	—	1	20	ms
	OVERSHOOT ¹	—	—	500	—	—	500	—	—	500	mV pk
CAPACITIVE LOAD ¹	25° C, NO EFFECT ON DC PERFORMANCE	—	—	100	—	—	100	—	—	100	μF

Notes:

All temperatures refer to case temperature, Tc.

1. Guaranteed by design, not tested.

2. Specified at 50% load.

3. With a series inductor on the Vin power lead (Lin = 6 μH).

4. Maximum duration of short circuit: 90 seconds at 25°C, 30 seconds at 125°C.

5. Load fault is a short circuit into 1Ω. Recovery is into resistive full load.

6. Transition > 10 μs.

7. Measured from release of inhibit until Vout settles to within 1% of final value at full load with Vin at 28V.

8. Recovery = time to settle to within 1% of Vout final value.

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Electrical Characteristics: -55° to + 125°C Tc, 28 VDC Vin, balanced 100% load, unless otherwise specified.

DUAL OUTPUT MODELS		SLH2805D			SLH2812D			SLH2815D			UNITS
PARAMETER	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
OUTPUT VOLTAGE ²	25°C +V _{OUT}	4.95	5.00	5.05	11.88	12.00	12.12	14.85	15.00	15.15	VDC
	25°C -V _{OUT}	-4.95	-5.00	-5.05	-11.88	-12.00	-12.12	-14.85	-15.00	-15.15	
	-55 to +125° C +V _{OUT}	4.80	—	5.20	11.52	—	12.48	14.40	—	15.60	
	-55 to +125° C -V _{OUT}	-4.80	—	-5.20	-11.52	—	-12.48	-14.40	—	-15.60	
OUTPUT CURRENT ⁷	EITHER OUTPUT V _{IN} = 16 TO 40 VDC	—	150	240	—	62.5	100	—	50	80	mA
	TOTAL, V _{IN} = 16 TO 40 VDC	—	—	300	—	—	125	—	—	100	
OUTPUT POWER	V _{IN} = 16 TO 40 VDC	—	—	1.5	—	—	1.5	—	—	1.5	W
OUTPUT RIPPLE ±V _{OUT}	25°C 10 kHz TO 2 MHz	—	75	150	—	40	200	—	65	300	mV p-p
	10 kHz TO 2 MHz	—	—	250	—	—	400	—	—	500	
LINE REGULATION V _{IN} = 16 TO 40 VDC	+V _{OUT}	—	75	400	—	75	700	—	85	650	mV
	-V _{OUT}	—	65	400	—	70	700	—	85	650	
LOAD REGULATION ⁸ BALANCED, 10% TO 100%	+V _{OUT}	—	310	700	—	350	700	—	370	700	mV
	-V _{OUT}	—	300	700	—	350	700	—	370	700	
INPUT VOLTAGE	NO LOAD TO FULL CONTINUOUS	16	28	40	16	28	40	16	28	40	VDC
	TRANSIENT 50 ms ¹	—	—	50	—	—	50	—	—	50	V
INPUT CURRENT	NO LOAD	—	3.1	17	—	3.1	17	—	3.3	17	mA
	INHIBITED	—	1.4	5	—	1.4	5	—	1.4	5	
INPUT RIPPLE CURRENT ³	10 kHz - 10 MHz	—	80	250	—	90	300	—	100	300	mA p-p
EFFICIENCY	25°C, FULL LOAD	72	80	—	80	87	—	80	87	—	%
	FULL LOAD	69	—	—	69	—	—	69	—	—	
LOAD FAULT ⁴ ±V _{OUT}	SHORT CIRCUIT POWER DISSIPATION	—	0.3	1.5	—	0.3	1.2	—	0.3	1.2	W
	RECOVERY ¹	—	—	30	—	—	30	—	—	30	ms
STEP LOAD RESPONSE ⁵ ±V _{OUT} BALANCED LOAD	50% - 100% - 50% TRANSIENT	—	±150	±400	—	±170	±600	—	±200	±700	mV pk
	RECOVERY ¹	—	—	600	—	—	360	—	—	600	μs
STEP LINE RESPONSE ^{1,5} ±V _{OUT} , 16 - 40 -16 VDC	TRANSIENT	—	—	±600	—	—	±600	—	—	±600	mV pk
	RECOVERY	—	—	500	—	—	500	—	—	500	μs
START-UP ±V _{OUT}	DELAY ⁶	—	1	20	—	2	20	—	2	20	ms
	OVERSHOOT ¹	—	—	500	—	—	500	—	—	500	mV pk
CAPACITIVE LOAD ¹	25° C, NO EFFECT ON DC PERFORMANCE	—	—	100	—	—	100	—	—	100	μF

Notes (see following page)

SLH Single and Dual DC/DC Converter Cases

28 VOLT INPUT – 1.5 WATT

Electrical Characteristics: -55° to + 125°C T_c, 28 VDC Vin, balanced 100% load, unless otherwise specified.

Notes SLH Dual Output Models:

All temperatures refer to case temperature, T_c

1. **Guaranteed by design, not tested.**

2. Specified at 50%/50% balanced load.

3. With a series inductor on the Vin power lead (L_{in} = 6 μH).

4. Load fault is a short circuit into 1Ω. Recovery is into resistive full load.

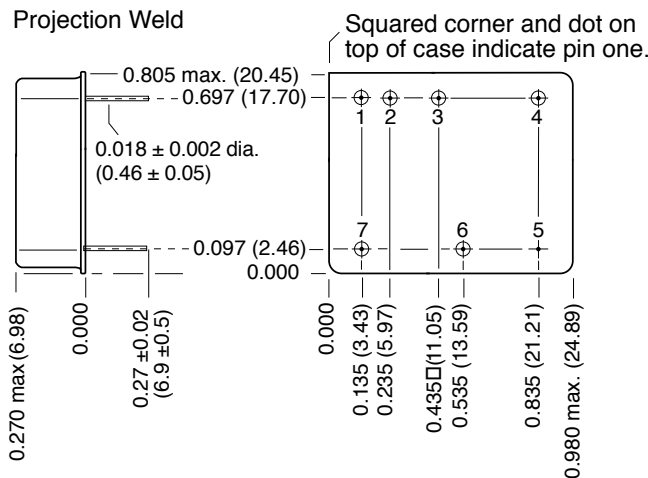
5. Transition > 10 μs. Recovery is time for Vout to settle to within 1% of final value.

6. Measured from release of inhibit until Vout settles to within 1% of final value at full load with Vin at 28V.

7. Maximum specification indicates 80% of the converter's total power is available from either output, provided the other output carries 20% of the total power.

8. Although no minimum load is required, at no load the output voltage may exceed rating by up to 15%.

BOTTOM VIEW CASE A2



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 Kovar/Nickel/Gold

Cover Kovar/Nickel

Pins Kovar/Nickel/Gold matched glass seal

Case A2, Rev D, 20081119

Please refer to the numerical dimensions for accuracy. All information is believed to be accurate, but no responsibility is assumed for errors or omissions. Interpoint reserves the right to make changes in products or specifications without notice.

FIGURE 2: CASE A2

SLH Single and Dual DC/DC Converters

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CLASS H AND K, MIL-PRF-38534 ELEMENT EVALUATION

COMPONENT-LEVEL TEST PERFORMED	SPACE PROTOTYPE (O) NON-QML ¹		CLASS H QML		CLASS K QML	
	M/S ²	P ³	M/S ²	P ³	M/S ²	P ³
Element Electrical	yes	no	yes	yes	yes	yes
Element Visual	no	no	yes	yes	yes	yes
Internal Visual	no	N/A	yes	N/A	yes	N/A
Temperature Cycling	no	no	no	no	yes	yes
Constant Acceleration	no	no	no	no	yes	yes
Interim Electrical	no	N/A	no	N/A	yes	N/A
Burn-in	no	N/A	no	N/A	yes	N/A
Post Burn-in Electrical	no	N/A	no	N/A	yes	N/A
Steady State Life	no	N/A	no	N/A	yes	N/A
Voltage Conditioning Aging	N/A	no	N/A	no	N/A	yes
Visual Inspection	no	no	N/A	no	N/A	yes
Final Electrical	no	no	yes	yes	yes	yes
Wire Bond Evaluation ⁴	no	no	yes	yes	yes	yes
SEM	no	N/A	no	N/A	yes	N/A
SLAM™/C-SAM: Input capacitors only (Add'l test, not req. by H or K)	no	no	no	yes	no	yes

Notes:

1. Non-QML products do not meet all of the requirements of MIL-PRF-38534.
2. M/S = Active components (Microcircuit and Semiconductor Die)
3. P = Passive components
4. Not applicable to EMI filters that have no wirebonds.

Definitions:

Element Evaluation: Component testing/screening per MIL-STD-883 as determined by MIL-PRF-38534

SEM: Scanning Electron Microscopy

SLAM™: Scanning Laser Acoustic Microscopy

C-SAM: C - Mode Scanning Acoustic Microscopy

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CLASS H AND K, MIL-PRF-38534 ENVIRONMENTAL SCREENING

END ITEM-LEVEL TEST PERFORMED	SPACE PROTOTYPE (O) NON-QML ¹	CLASS H QML	CLASS K QML
Non-destruct bond pull ² Method 2023	no	yes ³	yes
Pre-cap Inspection Method 2017, 2032	yes	yes	yes
Temperature Cycle (10 times) Method 1010, Cond. C, -65°C to 150°C, ambient	yes	yes	yes
Constant Acceleration Method 2001, 3000 g	yes	yes	yes
PIND Test Method 2020, Cond. A	no	yes ³	yes
Pre burn-in test	yes	yes	yes
Burn-in Method 1015, 125°C case, typical			
96 hours	yes	no	no
160 hours	no	yes	no
2 x 160 hours (includes mid-BI test)	no	no	yes
Final Electrical Test MIL-PRF-38534 Group A, Subgroups 1 through 6 -55°C, +25°C, +125°C case	yes	yes	yes
Radiography Method 2012	N/A	N/A	yes
Post Radiography Electrical Test Room temperature	N/A	N/A	yes ³
Hermeticity Test Fine Leak, Method 1014, Cond. A	yes	yes	yes
Gross Leak, Method 1014, Cond. C	yes	yes	yes
Final visual inspection Method 2009	yes	yes	yes

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

Notes:

1. Space Prototype (O), non-QML products, do not meet all of the requirements of MIL-PRF-38534.
2. Not applicable to EMI filters that have no wirebonds.
3. Not required by DSCC but performed to assure product quality.

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28 VOLT INPUT – 1.5 WATT

CLASS H AND K, MIL-PRF-38534 RADIATION ASSURANCE

RADIATION HARDNESS ASSURANCE LEVELS	ENVIRONMENTAL SCREENING LEVELS		
	SPACE PROTOTYPE (O) NON-QML ²	CLASS H QML	CLASS K QML
O¹ : Standard, no radiation guarantee	OO	HO	N/A
R³ : Radiation tolerant–Tested lots up to 100 K Rads (Si) total dose SEU guarantee up to 40 MeV	N/A	HR	KR

Notes:

1. 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".
2. Space Prototype (O), non-QML, products do not meet all of the requirements of MIL-PRF-38534.
3. Redmond site, Interpoint, has a Radiation Hardness assurance plan on file with DSCC.