SMTR Single, Dual and Triple DC/DC Converters

28 VOLT INPUT – 30 WATT – PENDING REVISION F RELEASE

FEATURES

Single, Dual and Triple models

- 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
- Transient protection 50 V for 50 ms
- Fully Isolated, magnetic feedback
- Fixed high frequency switching, 600 kHz
- Trim function or remote sense on single output models
- Inhibit function
- Synchronization function
- Indefinite short circuit protection
- Up to 84% efficiency (up to 73% efficiency triple models)

MODELS		
VDC Output		
SINGLE	DUAL	TRIPLE
1.5	±5	+5 & ±12
2.5	±12	+5 & ±15
3.3	±15	
5		
12		
15		

DESCRIPTION

The SMTR Series™ of 28 volt DC/DC converters offers up to 30 watts of output power from single, dual or triple output configurations. They operate over the full military temperature range of -55°C to +125°C with up to 84% efficiency (up to 73% efficiency triple models). SMTR converters are packaged in hermetically sealed metal enclosures, making them ideal for use in military, aerospace and other high reliability applications.

Screening

SMTR converters offer screening options to Space Prototype (O), Class H, or Class K. Radiation tolerant to Radiation Hardness Assurance (RHA) levels of "-" (O), "P," 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, MIL-PRF-38534 Screening" tables for more information.

Converter Design

The SMTR converters are constant frequency, pulse-width modulated switching regulators which use a quasi-square wave, single ended, forward converter design. Tight load regulation is maintained by using a wide bandwidth magnetic feedback and, on single output models, through use of remote sense. On dual output models, the positive output is independently regulated and the negative output is cross regulated through the use of tightly-coupled magnetics. The SMTR Triple Series DC/DC converter's design includes individual regulators on the auxiliary outputs which provide for no cross regulation error when a minimum 300 mA load is maintained on the main (+5) output.

SMTR converters have internal input filter that help reduce the need for external components in normal operation. For systems that require compliance with MIL-STD-461C's CE03 standard, Interpoint offers filter/transient suppression modules (including the SFMC-461 and SFCS28-461), which will result in compliance. For the lowest noise performance, connection of the case to input common is recommended. The connection can be hard-wired or AC coupled with a small ceramic bypass capacitor. Indefinite short circuit protection and overload protection are provided by a constant current-limit feature. This protective system senses current in the converter's secondary stage and limits it to approximately 125% of the maximum rated output current.

Synchronization

Synchronizing the converter with the system clock allows the designer to confine switching noise to clock transitions, minimizing interference and reducing the need for filtering. In sync mode, the converter will run at any frequency between 500 kHz and 675 kHz. The sync control operates with an active high at any duty cycle between 40% and 60%. The sync pin should be connected to input common pin when not in use.

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Wide Voltage Range

SMTR converters are designed to provide full power operation over a full 16 to 40 VDC voltage range. Operation below 16 volts, including MIL-STD-704D emergency power conditions is possible with derated power.

Improved Dynamic Response

The SMTR Series feed-forward compensation system provides excellent dynamic response and noise rejection. Audio rejection is typically 50 dB (for Triple output models). The min. to max. step line transient response is typically less than 4%.

Inhibit Function

SMTR converters provide an inhibit terminal that can be used to disable internal switching, resulting in no output and very low quiescent input current. The converter is inhibited when an active low (≤0.8V) 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 VDC. In the inhibit mode, a maximum of 8 mA must be sunk from the inhibit pin.

TRIM AND REMOTE SENSE (AVAILABLE ON SINGLE OUTPUT MODELS ONLY)

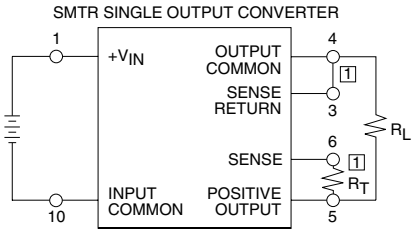


Figure 1: Trim Connection[1, 2, 3]

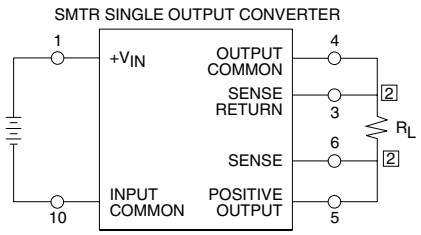


Figure 2: Remote Sense[2, 3]

Trim Formulas

Vout = desired output voltage; Rt = trim resistor

3.3V: $Rt = \frac{1300 * Vout - 4304}{1.2475}$

5V: $Rt = \frac{1300 * Vout - 6512}{1.2475}$

12V: $Rt = \frac{1300 * Vout - 15631}{1.2475}$

15V: $Rt = \frac{1300 * Vout - 19498}{1.2475}$

Notes for Remote Sense and Trim

1. When trimming output voltage and/or remote sensing, the total output voltage increase must be less than 0.6 volts at the converters pins to maintain specified performance.
2. If neither voltage trim nor remote sense will be used, connect pin 3 to pin 4 and pin 5 to pin 6 or the output voltage will increase by 1.2 volts.
3. CAUTION: The converter will be permanently damaged if the positive remote sense (pin 6) is shorted to ground. Damage may also result if the output common or positive output is disconnected from the load with the remote sense leads connected to the load.

SMTR Single, Dual and Triple DC/DC Converters

28 VOLT INPUT – 30 WATT – PENDING REVISION F RELEASE

OPERATING CONDITIONS AND CHARACTERISTICS

Input Voltage Range
- 16 to 40 VDC continuous
- 50 V for 50 msec transient

Output Power
- Up to 30 watts depending on model

Lead Soldering Temperature (10 sec per pin)
- 300°C

Storage Temperature Range (Case)
- -65°C to +135°C

Case Operating Temperature (Tc)
- -55°C to +125°C full power
- -55°C to +135°C absolute

Derating Output Power/Current
- Linearly from 100% at 125°C to 0% at 135°C

Output Voltage Temperature Coefficient
- 100 ppm/°C typical single and dual outputs
- 200 ppm/°C main, 300 ppm/°C aux triple output

Input to Output Capacitance
- 50 pF typ (100 pF typ triple outputs)

Current Limit
- 125% of full load typical

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

Audio Rejection
- 40 dB typ (50 dB typ, triple output)

Conversion Frequency
- Free run 550 min, 600 typ, 650 max kHz
- External sync 500 to 675 kHz

SYNC AND INHIBIT

Sync
- Input frequency 500 to 675 kHz
- Duty cycle 40% min, 60% max
- Active low 0.8 V max
- Active high 4.5 V min, 5 V max
- Referenced to input common
- If not used, connect to input common

Inhibit
- Active low (output disabled)
  - Voltage ≤0.8 V
  - Inhibit pin source current 8.0 mA max
  - Referenced to input common
- Active high (output enabled)
  - Open collector or unconnected
  - If not used, leave unconnected
  - Inhibit pin voltage, 9 to 11 V

MECHANICAL AND ENVIRONMENTAL

Size (maximum)
- Single and dual output
  - Non-flanged: 2.125 x 1.115 x 0.400 inches (53.98 x 28.58 x 10.16 mm) See case H2 for dimensions.
  - Flanged: 2.910 x 1.115 x 0.400 inches (73.79 x 28.58 x 10.16 mm) See case K3 for dimensions.
- Triple output
  - Non-flanged: 1.950 x 1.350 x 0.405 inches (49.53 x 34.29 x 10.29 mm) See case F1 for dimensions.
  - Flanged: 2.720 x 1.350 x 0.405 inches (69.09 x 34.29 x 10.29 mm) See case J1 for dimensions.

Weight (maximum)
- Single and dual non-flanged 50 grams, flanged 52 grams
- Triple non-flanged 58 grams, flanged 62 grams

Screening

Space Prototype (O), Class H, or Class K are radiation tolerant to Radiation Hardness Assurance (RHA) levels of “-” (O), “P” 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, MIL-PRF-38534 Screening” tables for more information, page 21. Available configurations are: OO, HP, KP, HR, and KR

SMTR Single, Dual and Triple DC/DC Converters

28 VOLT INPUT – 30 WATT – PENDING REVISION F RELEASE

PIN OUT			
Pin	Single Output	Dual Output	Triple Output
1	Positive Input	Positive Input	Positive Input
2	Inhibit	Inhibit	Main (+5) Output
3	Sense Return	Positive Output	Output Common
4	Output Common	Output Common	Neg. Aux. Output
5	Positive Output	Negative Output	Pos. Aux. Output
6	Positive Sense	Case Ground	Case Ground
7	Case Ground	Case Ground	Case Ground
8	Case Ground	Case Ground	Inhibit
9	Sync	Sync	Sync
10	Input Common	Input Common	Input Common

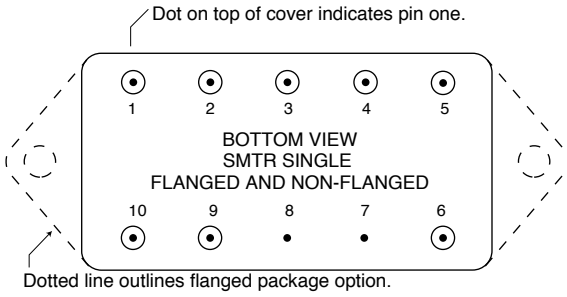


FIGURE 3: PIN OUT SINGLE OUTPUT MODELS
See cases H2 and K3 for dimensions.

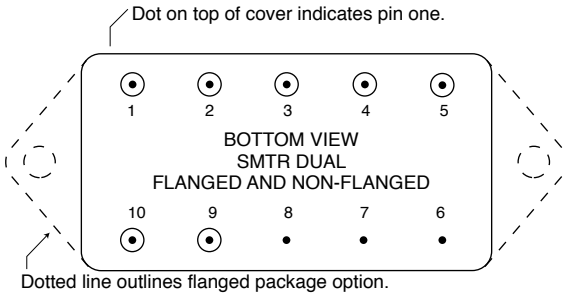


FIGURE 4: PIN OUT DUAL OUTPUT MODELS
See cases H2 and K3 for dimensions.

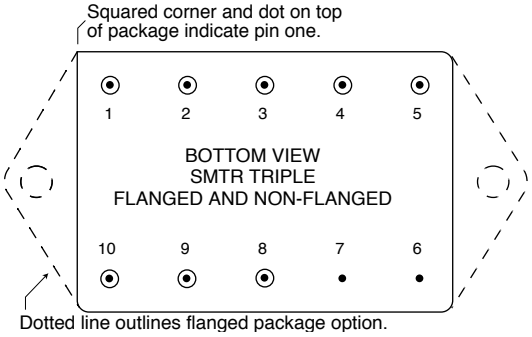


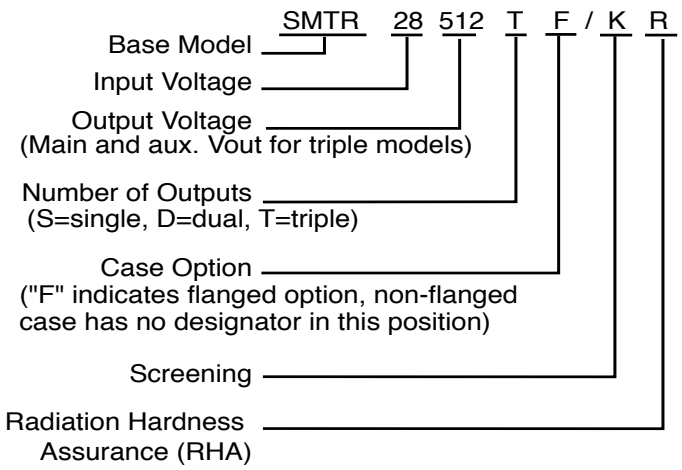
FIGURE 5: PIN OUT SMTR TRIPLE
See cases F1 and J1 for dimensions.

PINS NOT IN USE	
Inhibit	Leave unconnected
Sync In	Connect to Input Common
Sense Lines	Must be connected to appropriate outputs

SMTR Single, Dual and Triple DC/DC Converters

28 VOLT INPUT – 30 WATT – PENDING REVISION F RELEASE

MODEL NUMBERING KEY



SMD NUMBERS

Standard Microcircuit Drawing (SMD)	SMTR Similar Part
IN PROCESS	SMTR281R5S/KR
IN PROCESS	SMTR282R5S/KR
5962R0150102KXC	SMTR283R3S/KR
5962R9306802KXC	SMTR2805S/KR
5962R9306902KXC	SMTR2812S/KR
5962R9307002KXC	SMTR2815S/KR
5962R9320502KXC	SMTR2805D/KR
5962R9307102KXC	SMTR2812D/KR
5962R9307202KXC	SMTR2815D/KR
IN PROCESS	SMTR28512T/KR
5962R9307402KXC	SMTR28515T/KR

To indicate the flanged case option change the “X” to “Z” In the SMD number. The SMD number shown is for Class K screening, non-flanged, 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

SMTR28 _____ _____ _____ / _____ _____

BASE MODEL	V_{OUT} VALUE [1]	NUMBER OF OUTPUTS [2]	CASE OPTION [3]	SCREENING [4]	RHA [5]
	1R5, 2R5, 3R3, 05, 12, 15	**S**	(BLANK FOR NON-FLANGED)	**O**	**O**
	05, 12, 15	**D**	**F** (FLANGED)	**H**	**P**
	512, 515	**T**		**K**	**R**

Notes:
1. VOUT Value: An R indicates a decimal point. 1R5 is 1.5 volts out. The values os 1R5, 2R5, and 3R3 are only available in single output models. The 512 and 515 triple output converters are +5 volt main and ±12 or ±15 volt auxiliaries.
2. S is a single output, D is a dual output, and T is a triple output
3. The case option is left blank for the standard, non-flanged, case. For the flanged case, use an F in the case option.
4. A screening level of O is a Space Prototype and is only used with RHA O.
5. 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 page 21 for more information.

SMTR Single, Dual and Triple DC/DC Converters

28 VOLT INPUT – 30 WATT – PENDING REVISION F RELEASE

Electrical Characteristics: -55 to +125° C T_C, 28 VDC Vin, 100% load, no irraditaion, unless otherwise specified.

SINGLE OUTPUT MODELS		SMTR281R5S			SMTR285R2S			SMTR283R3S			UNITS
PARAMETER	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
OUTPUT VOLTAGE	25°C	1.485	1.50	1.515	2.475	2.50	2.525	3.267	3.30	3.333	VDC
		1.455	—	1.545	2.425	—	2.575	3.201	—	3.399	
OUTPUT CURRENT	VIN = 16 TO 40 VDC	0	—	8.0	0	—	8.0	0	—	6.06	A
OUTPUT POWER [2]	VIN = 16 TO 40 VDC	—	—	12	—	—	20	—	—	20	W
OUTPUT RIPPLE 10 KHZ TO 2 MHZ	25°C	–	20	50	—	25	65	—	20	40	mV p-p
		—	—	50	—	—	65	—	—	50	
LINE REGULATION	VIN = 16 TO 40 VDC	—	—	10	—	—	10	—	—	10	mV
LOAD REGULATION	NO LOAD TO FULL	—	–	10	—	—	10	—	—	10	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	25°C, NO LOAD	—	30	60	—	30	60	—	30	75	mA
	NO LOAD	—	—	90	—	—	100	—	—	75	
	INHIBITED	—	—	8	—	—	8	—	—	8	
INPUT RIPPLE CURRENT [3]	10 KHZ - 10 MHZ	—	—	50	—	—	50	—	—	50	mA p-p
EFFICIENCY	25°C	57	61	—	68	71	—	70	76	—	%
		55	—	—	66	—	—	66	—	—	
LOAD FAULT [7]	SHORT CIRCUIT POWER DISSIPATION	—	—	13	—	—	13	—	—	12	W
	RECOVERY [1]	—	—	6	—	—	6	—	—	6	ms
STEP LOAD RESPONSE [5]	50% - 100% - 50% LOAD TRANSIENT	—	—	±125	—	—	±150	—	—	±250	mV pk
	RECOVERY [1, 4]	—	—	200	—	—	200	—	—	200	µs
STEP LINE RESPONSE [1, 5] 16 - 40 -16 VDC	TRANSIENT	—	—	±300	—	—	±300	—	—	±300	mV pk
	RECOVERY [4]	—	—	300	—	—	300	—	—	300	µs
START-UP [6]	DELAY	—	—	5	—	—	5	—	—	5	ms
	OVERSHOOT FULL LOAD[1]	—	—	30	—	—	30	—	—	50	mV pk
	OVERSHOOT NO LOAD[1]	—	—	75	—	—	125	—	—	150	
CAPACITIVE LOAD [1]	25°C , NO EFFECT ON DC PERFORMANCE	—	—	1000	—	—	1000	—	—	300	µF

Notes (All temperatures in tables and notes refer to case temperature, T_C.)
1. Guaranteed by design, not tested.
2. Operation is limited below 16 V (see Figure 22).
3. Tested with 6800 pF ceramic bypass capacitors connected externally from input common to case.
4. Recovery time is measured from application of the transient to the point at which Vout is within 1% of final value.
5. Transient transition time > 10 µs.
6. Tested on release from inhibit.
7. Short circuit protection not guaranteed above 125°C case temperature.

SMTR Single, Dual and Triple DC/DC Converters

28 VOLT INPUT – 30 WATT – PENDING REVISION F RELEASE

Electrical Characteristics: -55 to +125° C T_C, 28 VDC Vin, 100% load, no irraditaion, unless otherwise specified.

SINGLE OUTPUT MODELS		SMTR282805S			SMTR2812S			SMTR2815S			UNITS
PARAMETER	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
OUTPUT VOLTAGE	25°C	4.95	5.00	5.05	11.88	12.00	12.12	14.85	15.00	15.15	VDC
		4.85	—	5.15	11.64	—	12.36	14.70	—	15.30	
OUTPUT CURRENT	VIN = 16 TO 40 VDC	0	—	5.0	0	—	2.5	0	—	2.0	A
OUTPUT POWER [2]	VIN = 16 TO 40 VDC	—	—	25	—	—	30	—	—	30	W
OUTPUT RIPPLE 10 KHZ TO 2 MHZ	25°C	–	20	50	—	15	40	—	15	40	mV p-p
		—	—	90	—	—	90	—	—	90	
LINE REGULATION	VIN = 16 TO 40 VDC	—	—	50	—	—	50	—	—	50	mV
LOAD REGULATION	NO LOAD TO FULL	—	—	50	—	—	50	—	—	50	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	25°C, NO LOAD	—	35	75	—	35	75	—	35	75	mA
	NO LOAD	—	—	75	—	—	75	—	—	75	
	INHIBITED	—	—	8	—	—	8	—	—	8	
INPUT RIPPLE CURRENT [3]	10 KHZ - 10 MHZ	—	—	50	—	—	50	—	—	50	mA p-p
EFFICIENCY	25°C	74	78	—	78	83	—	79	84	—	%
		71	—	—	75	—	—	76	—	—	
LOAD FAULT [7]	SHORT CIRCUIT POWER DISSIPATION	—	—	12	—	—	12	—	—	12	W
	RECOVERY [1]	—	—	5	—	—	5	—	—	5	ms
STEP LOAD RESPONSE [5]	50% - 100% - 50% LOAD TRANSIENT	—	—	±300	—	—	±400	—	—	±500	mV pk
	RECOVERY [1, 4]	—	—	200	—	—	200	—	—	200	µs
STEP LINE RESPONSE [1, 5] 16 - 40 -16 VDC	TRANSIENT	—	—	±300	—	—	±500	—	—	±600	mV pk
	RECOVERY [4]	—	—	300	—	—	300	—	—	300	µs
START-UP [6]	DELAY	—	—	5	—	—	5	—	—	5	ms
	OVERSHOOT FULL LOAD[1]	—	—	50	—	—	120	—	—	150	mV pk
	OVERSHOOT NO LOAD[1]	—	—	250	—	—	600	—	—	750	
CAPACITIVE LOAD [1]	25°C , NO EFFECT ON DC PERFORMANCE	—	—	300	—	—	3000	—	—	3000	µF

Notes
(All temperatures in tables and notes refer to case temperature, T_C.)
1. Guaranteed by design, not tested.
2. Operation is limited below 16 V (see Figure 22).
3. Tested with 6800 pF ceramic bypass capacitors connected externally from input common to case.
4. Recovery time is measured from application of the transient to the point at which Vout is within 1% of final value.
5. Transient transition time > 10 µs.
6. Tested on release from inhibit.
7. Short circuit protection not guaranteed above 125°C case temperature.

SMTR Single, Dual and Triple DC/DC Converters

28 VOLT INPUT – 30 WATT – PENDING REVISION F RELEASE

Electrical Characteristics: -55 to +125° C T_C, 28 VDC Vin, 100% load, no irraditaion, unless otherwise specified.

DUAL OUTPUT MODELS		SMTR2805D			SMTR2812D			SMTR2815D			UNITS
PARAMETER	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
OUTPUT VOLTAGE	25°C +VOUT	4.95	5.00	5.05	11.88	12.00	12.12	14.85	15.00	15.15	VDC
	25°C -VOUT	-4.93	5.00	-5.08	-11.82	-12.00	-12.18	-14.77	-15.00	-15.23	
	-55 TO +125°C +VOUT	4.85	—	5.15	11.64	—	12.36	14.55	—	15.45	
	-55 TO +125°C -VOUT	-4.83	—	-5.18	-11.58	—	-12.42	-14.47	—	-15.53	
OUTPUT CURRENT [2, 3]	EITHER OUTPUT VIN = 16 TO 40 VDC	0	2.50	4.50	0	1.25	2.25	0	1.00	1.80	A
OUTPUT POWER [3, 4]	VIN = 16 TO 40 VDC	—	—	25	—	—	30	—	—	30	W
OUTPUT RIPPLE ±VOUT 10 KHZ TO 2 MHZ	25°C	—	20	40	—	30	80	—	25	80	mV p-p
		—	—	90	—	—	120	—	—	120	
LINE REGULATION VIN = 16 TO 40 VDC	+VOUT	—	—	50	—	—	50	—	—	50	mV
	-VOUT	—	—	100	—	—	150	—	—	180	
LOAD REGULATION BALANCED, NO LOAD TO FULL	+VOUT	—	—	50	—	—	50	—	—	50	mV
	-VOUT	—	—	100	—	—	150	—	—	180	
CROSS REGULATION EFFECT ON $-V_{OUT}$ [1]	SEE NOTE 5	—	—	12	—	—	8.3	—	—	8	%
	SEE NOTE 6	—	—	6	—	—	6	—	—	6	
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	25°C, NO LOAD	—	35	75	—	50	75	—	50	75	mA
	NO LOAD	—	—	75	—	—	75	—	—	75	
	INHIBITED	—	—	8	—	—	8	—	—	8	
INPUT RIPPLE CURRENT [7]	10 KHZ - 10 MHZ	—	—	50	—	—	50	—	—	50	mA p-p
EFFICIENCY	25°C	74	76	—	77	80	—	78	81	—	%
		74	—	—	77	—	—	78	—	—	
LOAD FAULT [8] ±VOUT	SHORT CIRCUIT POWER DISSIPATION	—	—	10	—	—	10	—	—	10	W
	RECOVERY [1, 9]	—	—	5.0	—	—	5.0	—	—	5.0	ms
STEP LOAD RESPONSE [10] $\pm V_{OUT}$ BALANCED LOAD	50% - 100% - 50% LOAD TRANSIENT	—	—	±300	—	—	±300	—	—	±400	mV pk
	RECOVERY [9]	—	—	200	—	—	200	—	—	200	µs
STEP LINE RESPONSE [1,10] $\pm V_{OUT}$, 16 - 40 -16 VDC	TRANSIENT	—	—	±400	—	—	±400	—	—	±500	mV pk
	RECOVERY [9]	—	—	300	—	—	300	—	—	300	µs
START-UP $\pm V_{OUT}$	DELAY [7]	—	—	5	—	—	5	—	—	5	ms
	OVERSHOOT FULL LOAD [1]	—	—	180	—	—	120	—	—	150	mV pk
	OVERSHOOT NO LOAD [1]	—	—	250	—	—	600	—	—	750	
CAPACITIVE LOAD [1]	25°C, NO EFFECT ON DC PERFORMANCE	—	—	500	—	—	500	—	—	500	µF

Notes: See page 9

SMTR Single, Dual and Triple DC/DC Converters

28 VOLT INPUT – 30 WATT – PENDING REVISION F RELEASE

Notes SMTR Dual Output Models

(All temperatures in tables and notes refer to case temperature, T_C.)

1. **Guaranteed by design, not tested**.
2. The specified max current is available from either output.
3. Up to 90% of the total output current/power is available from either output providing the positive output is carrying at least 10% of the total output power.
4. Operation is limited below 16 V (see Figure 22).
5. Effect on the negative output under the following conditions:
   +Pout 20% to 80%; –Pout 80% to 20%
6. Effect on the negative output under the following conditions:
   +Pout 50%; –Pout 10% to 50%
7. Tested with 6800 pF ceramic bypass capacitors connected externally from input common to case.
8. Indefinite short circuit protection not guaranteed above 125°C case temperature.
9. Recovery time is measured from application of the transient to point at which Vout is within 1% of final value.
10. Transition time ≥ 10 μs.

SMTR Single, Dual and Triple DC/DC Converters

28 VOLT INPUT – 30 WATT – PENDING REVISION F RELEASE

Electrical Characteristics: -55 to +125° C T_C, 28 VDC Vin, 100% load, no irraditaion, unless otherwise specified.

TRIPLE OUTPUT MODEL – SMRT28512T		5 (MAIN)			+12 (+AUX)			-12 (-AUX)			UNITS
PARAMETER	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
OUTPUT VOLTAGE	25°C, +VOUT	4.95	5.00	5.05	11.82	12.00	12.18	11.82	12.00	12.18	
	+VOUT	4.85	5.00	5.15	11.58	12.00	12.42	11.58	12.00	12.42	VDC
OUTPUT CURRENT [2, 3]		0.30	—	4.00	—	—	±0.625	—	—	±0.625	A
OUTPUT POWER [2, 3]		—	—	20	—	—	7.5	—	—	7.5	
	TOTAL ALL OUTPUTS	—	—	30	—	—	—	—	—	—	
OUTPUT RIPPLE	10 kHz - 2 MHz	—	—	180	—	—	±120	—	—	±120	mV p-p
LINE REGULATION [4]	VIN 16 TO 40 VDC	—	—	20	—	—	±75	—	—	±75	mV
LOAD REGULATION [3, 4]		—	—	50	—	—	±75	—	—	±75	mV
INPUT VOLTAGE	CONTINUOUS	16	28	40	—	—	—	—	—	—	VDC
	TRANSIENT 50 ms [1]	—	—	50	—	—	—	—	—	—	V
INPUT CURRENT	NO LOAD	—	—	110	—	—	—	—	—	—	mA
	INHIBITED	—	—	6	—	—	—	—	—	—	
INPUT RIPPLE CURRENT [3]	10 kHz - 10 MHz	—	—	80	—	—	—	—	—	—	mA p-p
EFFICIENCY	25°C	71	73	—	—	—	—	—	—	—	%
		69	—	—	—	—	—	—	—	—	
LOAD FAULT [5] ALL OUTPUTS SHORTED	POWER DISSIPATION	—	—	14	—	—	—	—	—	—	W
	RECOVERY EACH OUTPUT[1]	—	—	6	—	—	—	—	—	—	ms
STEP LOAD RESPONSE [6, 7]	TRANSIENT	—	—	±400	—	—	±1500	—	—	±1500	mV pk
	RECOVERY	—	—	0.30	—	—	6	—	—	6	ms
STEP LINE RESPONSE [1]	VIN 16 TO 40 VDC TRANSIENT	—	—	±800	—	—	±800	—	—	±800	mV pk
	RECOVERY	—	—	5	—	—	5	—	—	5	ms
START-UP	DELAY	—	—	6	—	—	6	—	—	6	ms
	OVERSHOOT [1]	—	—	500	—	—	2000	—	—	2000	mV pk

Notes:
(All temperatures in tables and notes refer to case temperature, T_C.)

1. **Guaranteed by design, not tested.**
2. The sum of the two Aux outputs is not to exceed 10 watts. The maximum load per Aux output is 7.5 watts.
3. To maintain regulation when operating the ±Aux at full load, a minimum load of 300 mA is required on the main output. For Aux loads less than full load, a lower load (<300 mA) on the main output will maintain regulation.
4. Measured on each output one at a time with the other outputs at full load.
5. Indefinite short circuit protection not guaranteed above 125°C (case).
6. Response of each output as all outputs are simultaneously transitioned.
   Main: 50% - 100% - 50% of main full load
   Auxiliaries: 25% - 50% - 25% each, of total auxiliary full load
7. Recovery time is measured from application of the transient to point at which Vout is within 1% of regulation.
8. Tested on release from inhibit.

SMTR Single, Dual and Triple DC/DC Converters

28 VOLT INPUT – 30 WATT – PENDING REVISION F RELEASE

Electrical Characteristics: -55 to +125° C T_C, 28 VDC Vin, 100% load, no irraditaion, unless otherwise specified.

TRIPLE OUTPUT MODEL – SMRT28515T		5 (MAIN)			+15 (+AUX)			-15 (-AUX)			UNITS
PARAMETER	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
OUTPUT VOLTAGE	25°C	4.95	5.00	5.05	14.77	15.00	15.23	-14.77	-15.00	-15.23	VDC
		4.85	5.00	5.15	14.47	15.00	15.52	-14.47	-15.00	-15.52	
OUTPUT CURRENT [2, 3]		0.30	—	4.00	—	—	±0.50	—	—	±0.50	A
OUTPUT POWER [2, 3]		—	—	20	—	—	7.5	—	—	7.5	W
	TOTAL ALL OUTPUTS	—	—	30	—	—	—	—	—	—	
OUTPUT RIPPLE	10 kHz - 2 MHz	—	—	180	—	—	120	—	—	120	mV p-p
LINE REGULATION [4]	VIN 16 TO 40 VDC	—	—	20	—	—	75	—	—	75	mV
LOAD REGULATION [3, 4]		—	—	50	—	—	75	—	—	75	mV
INPUT VOLTAGE	CONTINUOUS	16	28	40	—	—	—	—	—	—	VDC
	TRANSIENT 50 ms [1]	—	—	50	—	—	—	—	—	—	V
INPUT CURRENT	NO LOAD	—	—	110	—	—	—	—	—	—	mA
	INHIBITED	—	—	6	—	—	—	—	—	—	
INPUT RIPPLE CURRENT [3]	10 kHz - 10 MHz	—	—	80	—	—	—	—	—	—	mA p-p
EFFICIENCY	25°C	72	73	—	—	—	—	—	—	—	%
		70	—	—	—	—	—	—	—	—	
LOAD FAULT [5] ALL OUTPUTS SHORTED	POWER DISSIPATION	—	—	14	—	—	—	—	—	—	W
	RECOVERY EACH OUTPUT[1]	—	—	6	—	—	—	—	—	—	ms
STEP LOAD RESPONSE [6, 7]	TRANSIENT	—	—	±400	—	—	±1500	—	—	±1500	mV pk
	RECOVERY	—	—	0.30	—	—	6	—	—	6	ms
STEP LINE RESPONSE [1]	VIN 16 TO 40 VDC TRANSIENT	—	—	±800	—	—	±800	—	—	±800	mV pk
	RECOVERY	—	—	5	—	—	5	—	—	5	ms
START-UP	DELAY	—	—	6	—	—	6	—	—	6	ms
	OVERSHOOT [1]	—	—	500	—	—	2000	—	—	2000	mV pk

Notes:
(All temperatures in tables and notes refer to case temperature, T_C.)

1. **Guaranteed by design, not tested.**
2. The sum of the two Aux outputs is not to exceed 10 watts. The maximum load per Aux output is 7.5 watts.
3. To maintain regulation when operating the ±Aux at full load, a minimum load of 300 mA is required on the main output. For Aux loads less than full load, a lower load (<300 mA) on the main output will maintain regulation.
4. Measured on each output one at a time with the other outputs at full load.
5. Indefinite short circuit protection not guaranteed above 125°C (case).
6. Response of each output as all outputs are simultaneously transitioned.
   Main: 50% - 100% - 50% of main full load
   Auxiliaries: 25% - 50% - 25% each, of total auxiliary full load
7. Recovery time is measured from application of the transient to point at which Vout is within 1% of regulation.
8. Tested on release from inhibit.

SMTR Single, Dual and Triple DC/DC Converters

28 VOLT INPUT – 30 WATT – PENDING REVISION F RELEASE

Typical Performance Curves: 25°C Tc, 28 VDC Vin, 100% load, free run, unless otherwise specified.

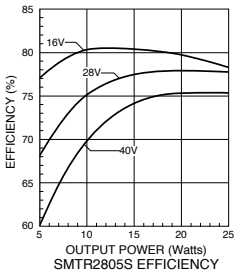


FIGURE 6

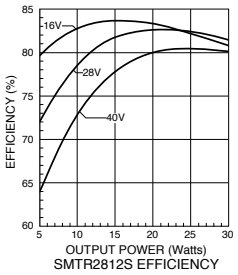


FIGURE 7

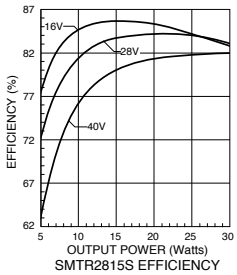


FIGURE 8

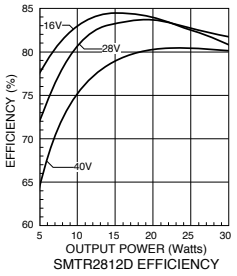


FIGURE 9

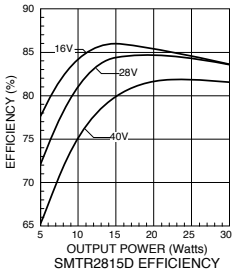


FIGURE 10

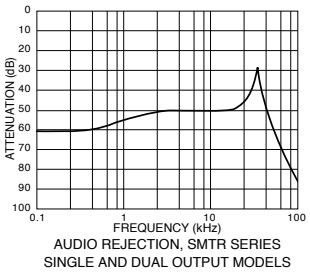


FIGURE 11

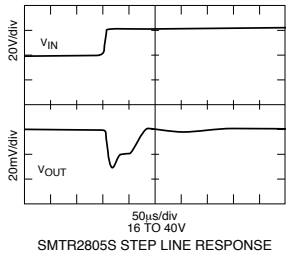


FIGURE 12

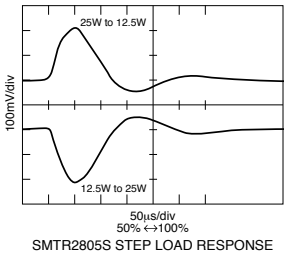


FIGURE 13

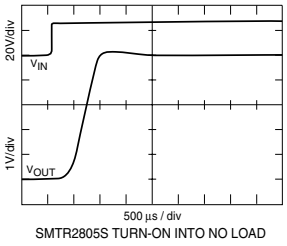
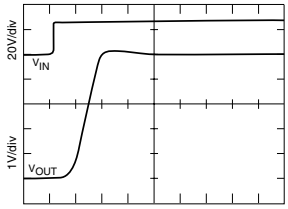


FIGURE 14

SMTR Single, Dual and Triple DC/DC Converters

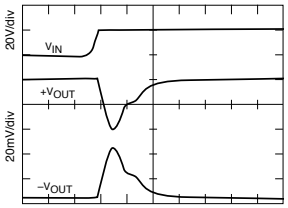
28 VOLT INPUT – 30 WATT – PENDING REVISION F RELEASE

Typical Performance Curves: 25°C Tc, 28 VDC Vin, 100% load, free run, unless otherwise specified.



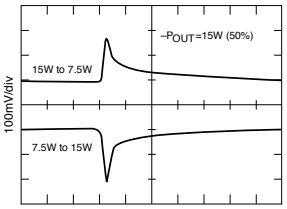
SMTR2805S TURN-ON INTO NO LOAD

FIGURE 15



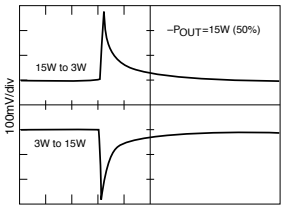
SMTR2815D STEP LINE RESPONSE

FIGURE 16



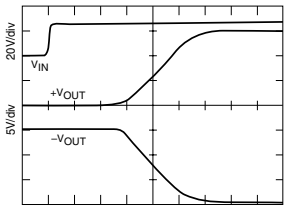
SMTR2815D $+V_{OUT}$ STEP LOAD RESPONSE

FIGURE 17 [1]



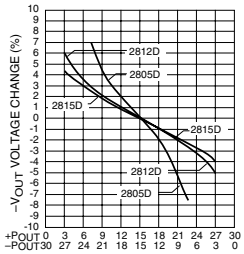
SMTR2815D $+V_{OUT}$ STEP LOAD RESPONSE

FIGURE 18 [1]



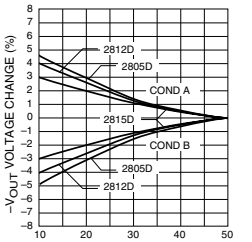
SMTR2815D TURN-ON INTO NO LOAD

FIGURE 19



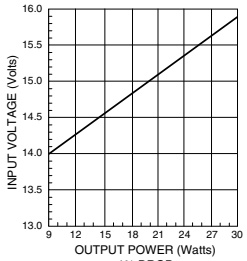
10% to 90% LOAD +V
90% to 10% LOAD –V
CROSS REGULATION

FIGURE 20



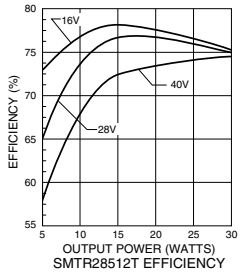
COND. B: 50% LOAD +V, 50% to 10% –V
COND. A: 50% LOAD –V, 50% to 10% +V
CROSS REGULATION

FIGURE 21



1% DROP
SMTR SINGLES AND DUALS
LOW LINE DROPOUT

FIGURE 22



SMTR28512T EFFICIENCY

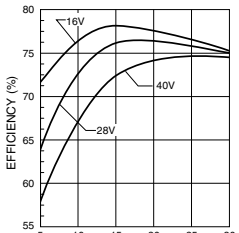
FIGURE 23

Notes:
1. Percent (%) of power refers to the percent of the total output power of the converter.

SMTR Single, Dual and Triple DC/DC Converters

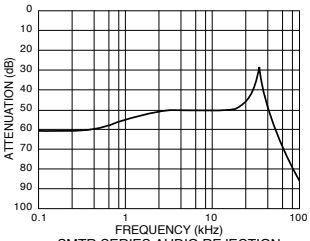
28 VOLT INPUT – 30 WATT – PENDING REVISION F RELEASE

Typical Performance Curves: 25°C Tc, 28 VDC Vin, 100% load, free run, unless otherwise specified.



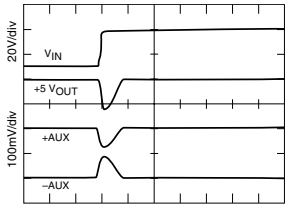
SMTR28515T EFFICIENCY

FIGURE 24



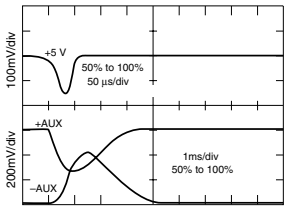
SMTR SERIES AUDIO REJECTION
TRIPLE OUTPUT MODELS

FIGURE 25



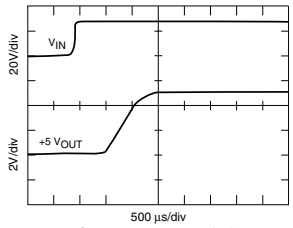
SMTR28515T STEP LINE RESPONSE

FIGURE 26



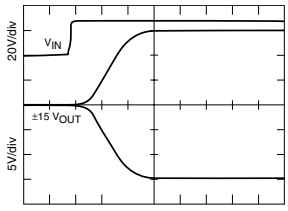
50% ↔ 100%
SMTR28515T STEP LOAD RESPONSE

FIGURE 27



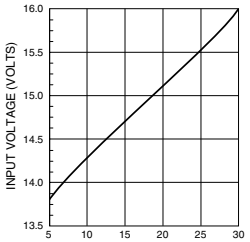
SMTR28515T, MAIN (+5)
TURN-ON INTO FULL LOAD

FIGURE 28



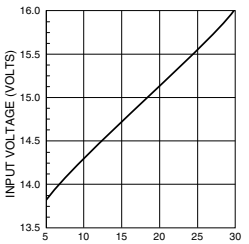
SMTR28515T, AUX. (±15)
TURN-ON INTO FULL LOAD

FIGURE 29



SMTR28512T
LOW LINE DROPOUT VS. LOAD

FIGURE 30



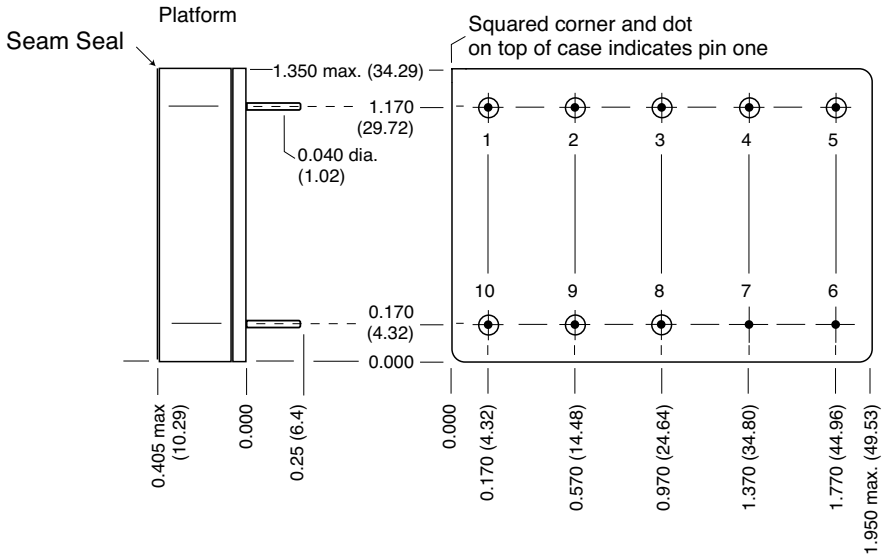
SMTR28515T
LOW LINE DROPOUT VS. LOAD

FIGURE 31

SMTR Single, Dual and Triple DC/DC Converter Cases

28 VOLT INPUT – 30 WATT – PENDING REVISION F RELEASE

BOTTOM VIEW CASE F1



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 ceramic seal

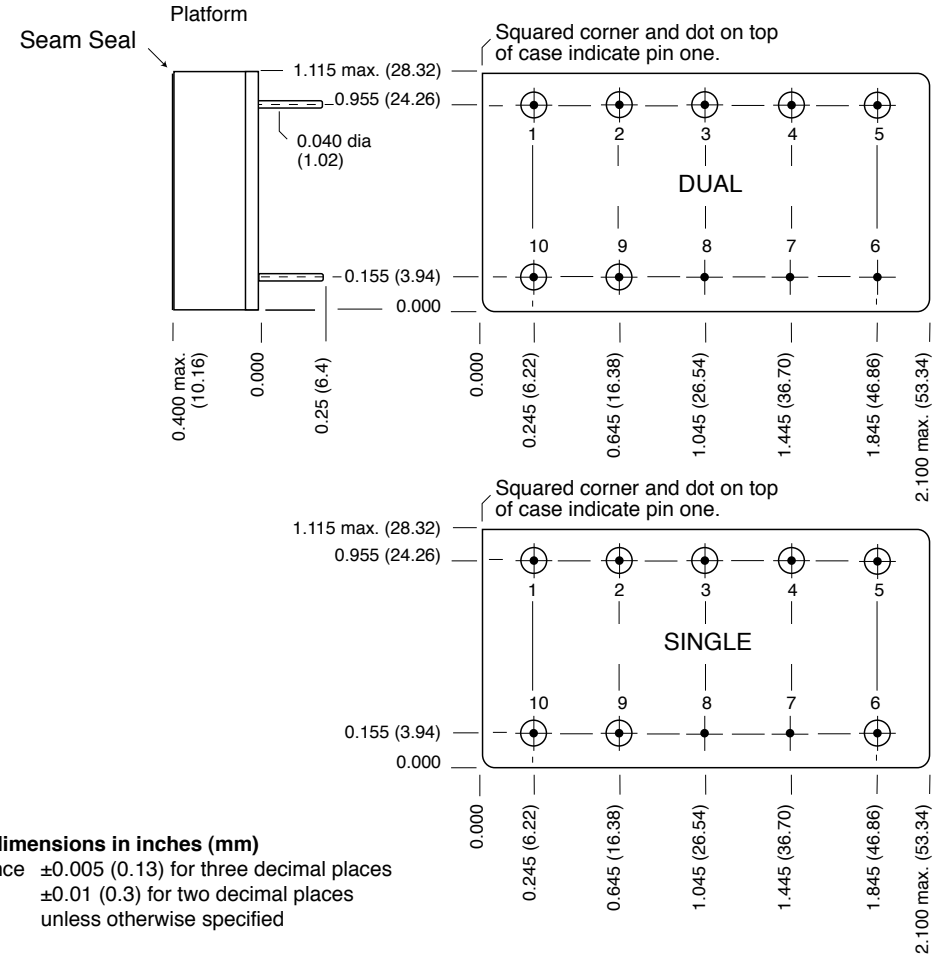
Case F1, Rev C, 20061211
Please refer to the numerical dimensions for accuracy. All information is believed to be accurate, but no responsibility is assumed for errors or omissions. Interpoint reserves the right to make changes in products or specifications without notice.

FIGURE 32: CASE F1 - TRIPLE OUTPUT MODELS

SMTR Single, Dual and Triple DC/DC Converter Cases

28 VOLT INPUT – 30 WATT – PENDING REVISION F RELEASE

BOTTOM VIEW CASE H2



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 ceramic seal

Case H2, Rev D - 20090212
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.

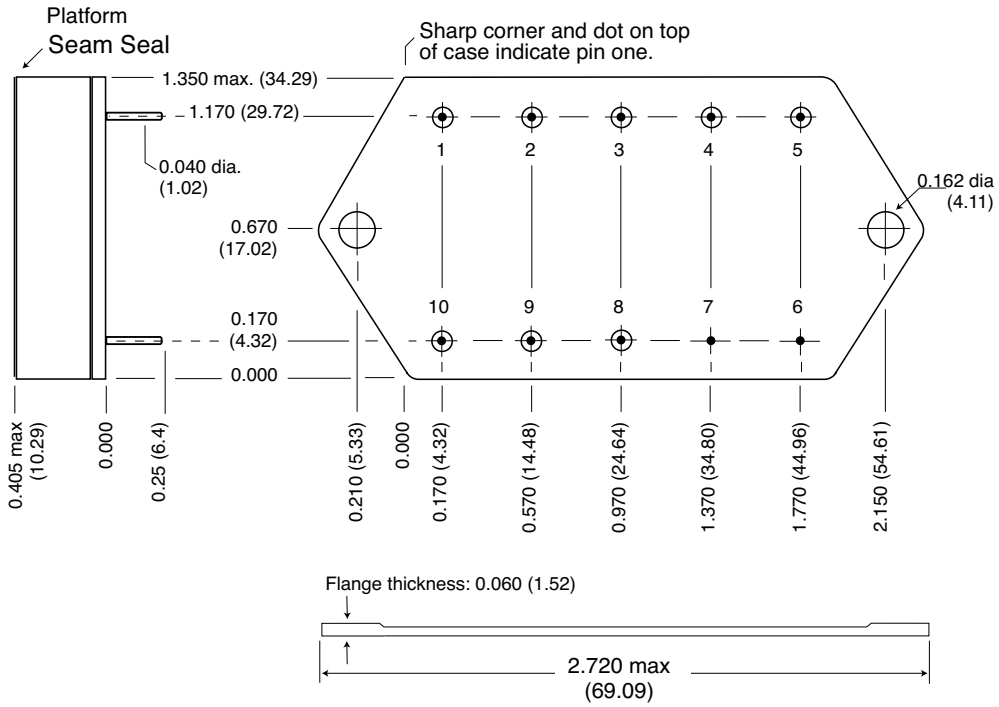
FIGURE 33: CASE H2 - SINGLE & DUAL OUTPUT MODELS

SMTR Single, Dual and Triple DC/DC Converter Cases

28 VOLT INPUT – 30 WATT – PENDING REVISION F RELEASE

BOTTOM VIEW CASE J1

Flanged cases: Designator "F" required in Case Option position of model number.



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 ceramic seal

Case J1, Rev D, 20061211
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.

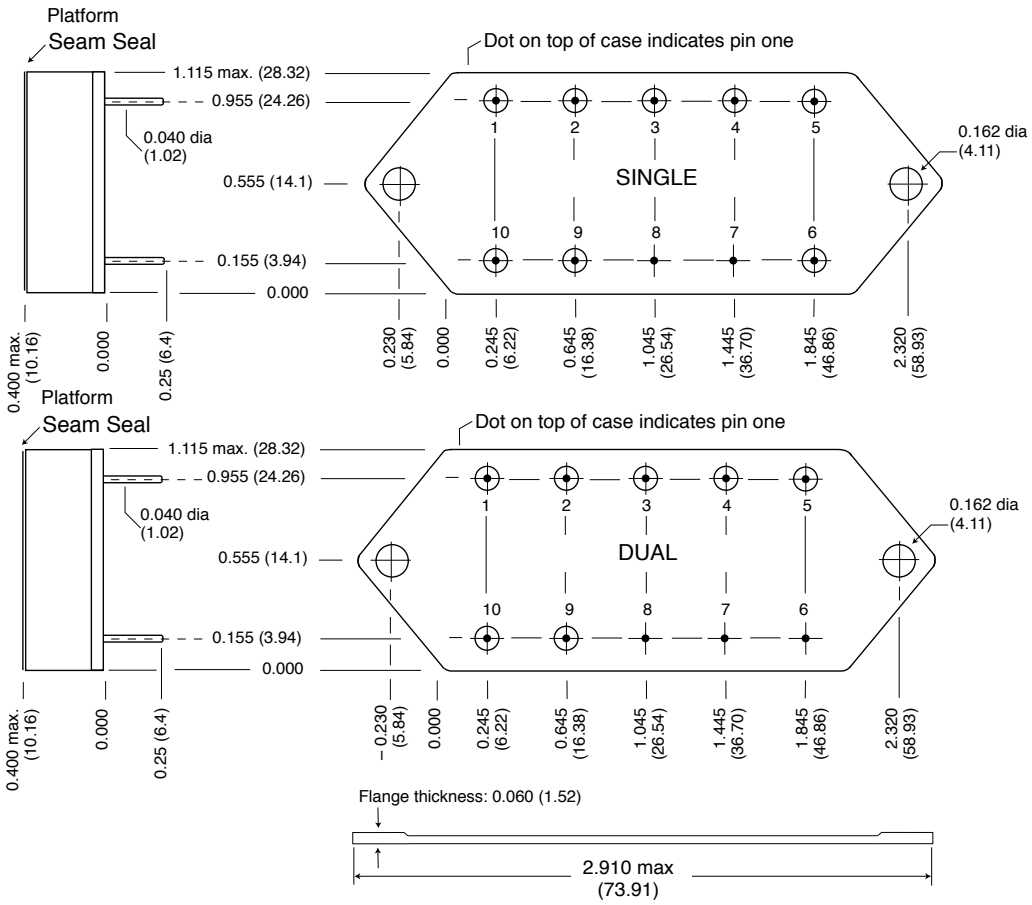
FIGURE 34: CASE J1 - TRIPLE OUTPUT MODELS

SMTR Single, Dual and Triple DC/DC Converter Cases

28 VOLT INPUT – 30 WATT – PENDING REVISION F RELEASE

BOTTOM VIEW CASE K3

Flanged cases: Designator “F” required in Case Option position of model number.



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

Materials
Header Cold Rolled Steel/Nickel/Gold
Cover Kovar/Nickel
Pins #52 alloy/Gold ceramic seal

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.

Case K3, Rev C, 20090212
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 35: CASE K3 - SINGLE & DUAL OUTPUT MODELS

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

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, 70 g @ 40 -200 Hz.	no	yes[3]	yes
Pre burn-in test	yes	yes	yes
Burn-in Method 1015, 125°C case, typical 96 hours 160 hours 2 x 160 hours (includes mid-BI test)	 yes no no	 no yes no	 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 Gross Leak, Method 1014, Cond. C	 yes yes	 yes 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.

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
O[1]: Standard, no radiation guarantee	OO	N/A	N/A
P[3]: Radiation tolerant–Tested lots up to 30 K Rads (Si) total dose SEU guarantee up to 40 MeV	N/A	HP	KP
R[3]: 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.