

# interpoint

10301 Willows Road

P.O. Box 97005

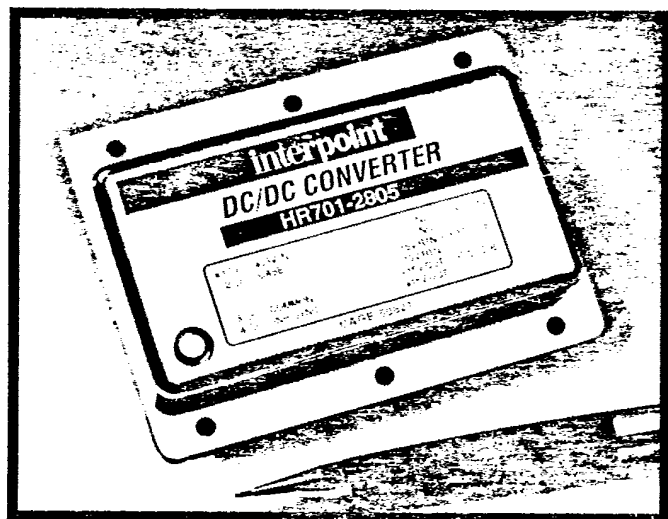
Redmond, WA 98073-9705

## HR700 SERIES DC-DC CONVERTERS

TEL: (206) 882-3100

TEL: (800) 822-8782

FAX: (206) 882-1990



- Up to 70 watts output power
- Hermetically sealed metal case
- Up to 83% efficiency
- Industrial converters with Military program reliability
- Burn in and stabilization bake standard
- External synchronization
- Short circuit protected
- 19-40 Vdc input range
- 20 watts per inch<sup>3</sup>
- -20 to +70°C operation

HR700 Series dc-dc converters offer up to 70 watts of power from single, dual, or triple outputs in one package. The converters combine the small size and high reliability of hybrid-based components, the high efficiency of switching regulators, and the isolation, regulation, and low noise characteristics of linear regulators.

### SMALL SIZE

The HR700 converters are manufactured using techniques that provide very small size and low profile components. Each converter uses less than eight square inches of board area and is .595 inch high or less. The overall power density is 20 watts per cubic inch.

### HIGH RELIABILITY

Assembled using thick-film hybrid technology, the HR700 converters are built to perform reliably in the harshest environments. The converters have more uniform thermal coefficients and 50% fewer connections than converters built by surface mount techniques. The HR700 parts use the same manufacturing procedures and quality controls that we apply to converters designed for commercial airliners, the space shuttle, advanced fighter aircraft, and other high reliability applications. The steel cases are hermetically sealed in a dry nitrogen environment and are guaranteed a maximum leak rate of less than 10<sup>-3</sup> atm-cc/sec. Stabilization bake and a 24-hour burn in at maximum operating temperature are standard for all parts. All devices are 100% electrically tested.

### HIGH PERFORMANCE

The HR700 series parts are high efficiency, low noise, pulse width modulated converters which utilize a quasi-square wave forward converter design with a nominal switching frequency of

245kHz. Isolation between input and output is provided with a transformer in the forward power loop and a wide band, temperature insensitive optical link in the feedback control loop. Short circuit protection is provided by detecting peak primary switching current on a cycle basis and limiting it to approximately 130% of the full load input current. This method results in quick and positive current limiting under short circuit conditions.

HR700 Series dc-dc converters are designed to provide full power operation over the input voltage range of 19-40 Vdc. Operation below an input of 19 volts is possible with derated output power. Outputs are available as 5, 12, and 15 Vdc in single, dual and triple outputs. The converters typically provide greater than 80% efficiency over the entire input range. Line regulation is typically within 0.1% and load regulation within 0.2%.

### LOW NOISE

The HR700 series converters offer low noise on both the input and output lines. A two section, four pole LC input filter is included to provide very low reflected line ripple current. Output ripple is maintained at less than 50mV p-p for single and dual output models and 85mV for triple output models.

### INHIBIT/SYNC FEATURE

An inhibit/sync pin is standard on all models of the HR700 series converters. The pin serves as both an output inhibit and as a synchronization input. In the inhibit mode an open collector TTL compatible low (<0.8Vdc) will disable internal switching thereby inhibiting the unit's output. Inhibiting in this manner results in an extremely low quiescent current.

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### SPECIFICATIONS (ALL MODELS) $T_A = 25^\circ\text{C}$ , $V_{IN} = 28\text{ Vdc}$ unless specified otherwise.

INPUT VOLTAGE RANGE: 19 to 40 Vdc (Note 4).

OPERATING TEMPERATURE RANGE:  $-20^\circ\text{C}$  to  $+70^\circ\text{C}$  (Case).STORAGE TEMPERATURE RANGE:  $-55^\circ\text{C}$  to  $+125^\circ\text{C}$  (Case).

OUTPUT VOLTAGE TEMPERATURE

COEFFICIENT: 150 ppm/ $^\circ\text{C}$  (Typical).

ISOLATION: 100 Mohm Minimum at 500 Vdc.

INPUT TO OUTPUT CAPACITANCE: 160 pF Typical.

CONVERSION FREQUENCY: 245 kHz Typical.

EXTERNAL SYNCHRONIZATION RANGE: Nominal to 370 kHz.

EXTERNAL SYNC. DUTY CYCLE: 70 to 98% high.

EXTERNAL SYNC. VOLTAGES: Logic High  $> +4.5\text{ Vdc}$ Logic Low  $< +0.8\text{ Vdc}$ 

OUTPUT INHIBIT PIN: Open collector TTL compatible

TTL Logic High (Open Circuit) = output enabled ( $\geq 4.5\text{ Vdc}$ )TTL Logic Low = output disabled ( $\leq 0.8\text{ Vdc}$ )OUTPUT INHIBIT PIN OPEN CIRCUIT VOLTAGE:  $+4.5$  to  $+5.5\text{ Vdc}$ .

OUTPUT INHIBIT PIN LOGIC LOW CURRENT: 1mA Max.

WEIGHT: 140 Grams Typical.

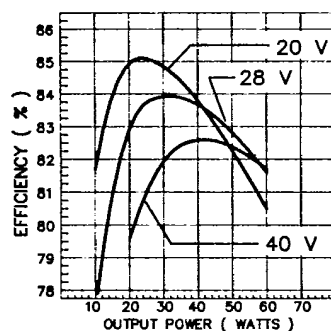
### CHARACTERISTICS (SINGLE OUTPUT MODELS) $T_A = 25^\circ\text{C}$ , $V_{IN} = 28\text{ Vdc}$ free run mode, unless specified otherwise.

| PARAMETER          | CONDITION                                  | HR701-2805 |      |       | HR701-2812 |       |       | HR701-2815 |       |       | UNITS |
|--------------------|--------------------------------------------|------------|------|-------|------------|-------|-------|------------|-------|-------|-------|
|                    |                                            | MIN.       | TYP. | MAX.  | MIN.       | TYP.  | MAX.  | MIN.       | TYP.  | MAX.  |       |
| OUTPUT VOLTAGE     | FULL LOAD                                  | 4.9        | 5.00 | 5.10  | 11.75      | 12.00 | 12.25 | 14.75      | 15.00 | 15.25 | VDC   |
| OUTPUT CURRENT     | FULL LOAD                                  | —          | —    | 12.00 | —          | —     | 5.83  | —          | —     | 4.67  | ADC   |
| OUTPUT POWER       | $TC = -55^\circ$<br>TO $+85^\circ\text{C}$ | —          | —    | 60    | —          | —     | 70    | —          | —     | 70    | WATTS |
| OUTPUT RIPPLE      | FULL LOAD<br>$BW \leq 2\text{MHz}$         | —          | 30   | 100   | —          | 30    | 100   | —          | 30    | 100   | mVp-p |
| INPUT CURRENT      | NO LOAD<br>INHIBITED                       | —          | 75   | 100   | —          | 70    | 100   | —          | 70    | 100   | mADC  |
|                    |                                            | —          | 30   | 35    | —          | 30    | 35    | —          | 30    | 35    |       |
| INPUT REFL. RIPPLE | FULL LOAD                                  | —          | 10   | 50    | —          | 10    | 50    | —          | 10    | 50    | mA    |
| EFFICIENCY         |                                            | 77         | 80   | —     | 80         | 83    | —     | 80         | 83    | —     | %     |
| LOAD REGULATION    | NO LOAD<br>TO FULL                         | —          | 10   | 30    | —          | 10    | 30    | —          | 10    | 30    | mVDC  |
| LINE REGULATION    | 19 TO 40<br>VDC                            | —          | 10   | 30    | —          | 10    | 30    | —          | 10    | 30    | mVDC  |
| STARTUP TIME       | WITH LOW<br>IMP. SOURCE                    | —          | 5    | 10    | —          | 8     | 10    | —          | 8     | 10    | mS    |

### DERATING INFORMATION

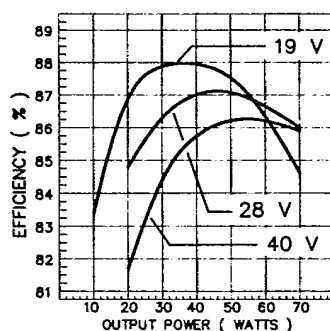
1. Linearly derate output power to zero watts at  $125^\circ\text{C}$ .
2. Above  $105^\circ\text{C}$  linearly derate steady state and transient input voltage to 33 and 38 volts respectively at  $125^\circ\text{C}$ .
3. Indefinite short circuit protection is not guaranteed above  $+70^\circ\text{C}$ .
4. Operation below an input voltage of 19 volts, including operation in MIL-STD-704D emergency power conditions is possible with derated output power. See Fig. 4.

### TYPICAL PERFORMANCE CURVES



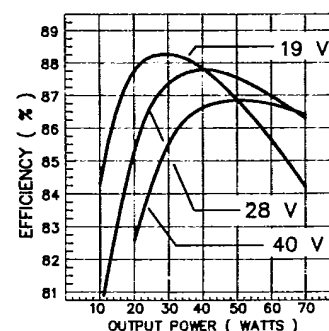
HR701-2805  
EFFICIENCY VS. LINE & LOAD

Figure 1



HR701-2812  
EFFICIENCY VS. LINE & LOAD

Figure 2



HR701-2815  
EFFICIENCY VS. LINE & LOAD

Figure 3

**interpoint****HR700 SERIES DC-DC CONVERTERS**

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**CHARACTERISTICS (DUAL/TRIPLE OUTPUT MODELS)**  $T_A = 25^\circ\text{C}$ ,  $V_{IN} = 28\text{ Vdc}$  free run mode, unless specified otherwise.

| PARAMETER                     | CONDITION                                                                                                 | HR702-2812 |       |        | HR702-2815 |       |        | HR703-2812 |       |        | HR703-2815 |       |        | UNITS                              |
|-------------------------------|-----------------------------------------------------------------------------------------------------------|------------|-------|--------|------------|-------|--------|------------|-------|--------|------------|-------|--------|------------------------------------|
|                               |                                                                                                           | MIN.       | TYP.  | MAX.   | MIN.       | TYP.  | MAX.   | MIN.       | TYP.  | MAX.   | MIN.       | TYP.  | MAX.   |                                    |
| OUTPUT VOLTAGE                | FULL LOAD MAIN DUAL                                                                                       | —          | —     | —      | —          | —     | —      | 4.90       | 5.05  | 5.15   | 4.9        | 4.95  | 5.1    | $\pm\text{DCV}$<br>$\pm\text{DCV}$ |
|                               |                                                                                                           | 11.75      | 12.00 | 12.25  | 14.75      | 15.00 | 15.25  | 11.50      | 11.80 | 12.1   | 15.05      | 15.30 | 15.75  |                                    |
| OUTPUT CURRENT                | $V_{IN} = 19\text{ to }40$ MAIN DUAL                                                                      | —          | —     | —      | —          | —     | —      | —          | 4.0   | 10.0   | —          | 4.0   | 10.0   | ADC                                |
|                               |                                                                                                           | —          | 2.92  | 5.5    | —          | 2.33  | 4.4    | —          | 1.67  | 4.2    | —          | 1.33  | 3.33   | NOTES 1 & 2                        |
| OUTPUT POWER                  | MAIN $\pm$ DUAL TOTAL                                                                                     | —          | —     | —      | —          | —     | —      | —          | 20    | 50     | —          | 20    | 50     | WATTS                              |
|                               |                                                                                                           | —          | 35    | 66.5   | —          | 35    | 66.5   | —          | 20    | 50     | —          | 20    | 50     |                                    |
|                               |                                                                                                           | —          | 70    | NOTE 1 | —          | 70    | NOTE 1 | —          | 60    | NOTE 2 | —          | 60    | NOTE 2 |                                    |
| OUTPUT RIPPLE                 | FULL LOAD MAIN DUAL<br>$BW \leq 2\text{MHz}$                                                              | —          | —     | —      | —          | —     | —      | —          | 50    | 100    | —          | 50    | 100    | mV p-p                             |
|                               |                                                                                                           | —          | 30    | 100    | —          | 30    | 100    | —          | 50    | 100    | —          | 50    | 100    |                                    |
| INPUT CURRENT                 | NO LOAD INHIBITED                                                                                         | —          | 75    | 100    | —          | 75    | 100    | —          | 35    | 115    | —          | 60    | 115    | mADC                               |
|                               |                                                                                                           | —          | 25    | 35     | —          | 25    | 35     | —          | 30    | 35     | —          | 25    | 35     |                                    |
| INPUT REFL. RIPPLE            | FULL LOAD<br>$BW \leq 10\text{MHz}$                                                                       | —          | 15    | 50     | —          | 15    | 50     | —          | 15    | 50     | —          | 15    | 50     | mA p-p                             |
| EFFICIENCY                    |                                                                                                           | 80         | 83    | —      | 80         | 83    | —      | 79         | 84    | —      | 79         | 84    | —      | %                                  |
| LOAD REGULATION               | NO LOAD TO FULL MAIN DUAL                                                                                 | —          | —     | —      | —          | —     | —      | —          | 5     | 30     | —          | 5     | 30     | mVDC                               |
|                               |                                                                                                           | —          | 25    | 50     | —          | 25    | 50     | —          | 480   | 750    | —          | 300   | 600    |                                    |
| LINE REGULATION               | $19\text{ to }40\text{V}$ MAIN DUAL                                                                       | —          | —     | —      | —          | —     | —      | —          | 2     | 25     | —          | 2     | 25     | mVDC                               |
|                               |                                                                                                           | —          | 10    | 30     | —          | 10    | 30     | —          | 100   | 225    | —          | 100   | 225    |                                    |
| STARTUP TIME                  |                                                                                                           | —          | 15    | 25     | —          | 15    | 25     | —          | 6     | 10     | —          | 6     | 10     | mS                                 |
| CROSS <sup>3</sup> REGULATION | DUAL $+P_o = 3\text{ W to }35\text{ W}$<br>$-P_o = 35\text{ W}$                                           | —          | 1.5   | 3.0    | —          | 1.5   | 3.0    | —          | —     | —      | —          | —     | —      | %                                  |
|                               | DUAL $+P_o = 20\text{ W to }50\text{ W}$<br>$-P_o = 50\text{ W to }20\text{ W}$                           | —          | 2.0   | 4.0    | —          | 2.0   | 3.5    | —          | —     | —      | —          | —     | —      |                                    |
| CROSS <sup>4</sup> REGULATION | MAIN $P_o = 30\text{ W}$<br>DUAL $+P_o = 3\text{ W to }27\text{ W}$<br>$-P_o = 27\text{ W to }3\text{ W}$ | —          | —     | —      | —          | —     | —      | —          | 2.3   | 6.0    | —          | 2.3   | 5.0    | %                                  |
|                               | MAIN $P_o = 3\text{ W to }30\text{ W}$<br>DUAL $\pm P_o = 15\text{ W}$                                    | —          | —     | —      | —          | —     | —      | —          | 5.4   | 9.0    | —          | 5.0   | 7.0    |                                    |

Note 1: On dual output models the maximum combined output power is 70 watts.

A maximum of 95% (66.5W) is available from any single output.

Note 2: On triple output models the maximum combined output power is 60 watts.

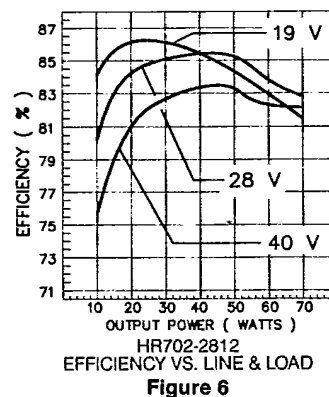
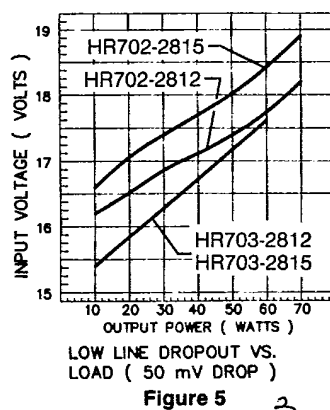
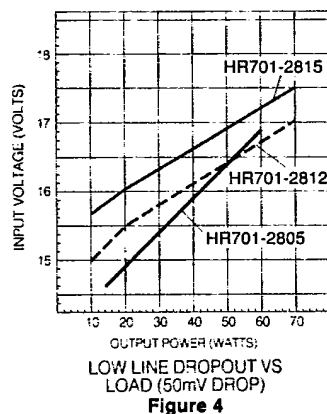
A maximum of 50 watts is available from a single output.

Note 3: Shows regulation effect on the negative dual output during the defined cross loading conditions.

Note 4: Shows regulation effect on both dual outputs during the defined cross loading conditions.

**DERATING INFORMATION**

- Derate output power linearly to zero at  $+125^\circ\text{C}$ .
- Above  $105^\circ\text{C}$  derate steady state and transient input voltage linearly to 33 and 38 volts respectively at  $+125^\circ\text{C}$ .
- Indefinite short circuit protection is not guaranteed above  $+70^\circ\text{C}$ .
- Operation below an input voltage of 19 Vdc, including operation in MIL-STD-704D emergency power conditions is possible with derated output power. (See Figure 5.)

**TYPICAL PERFORMANCE CURVES**

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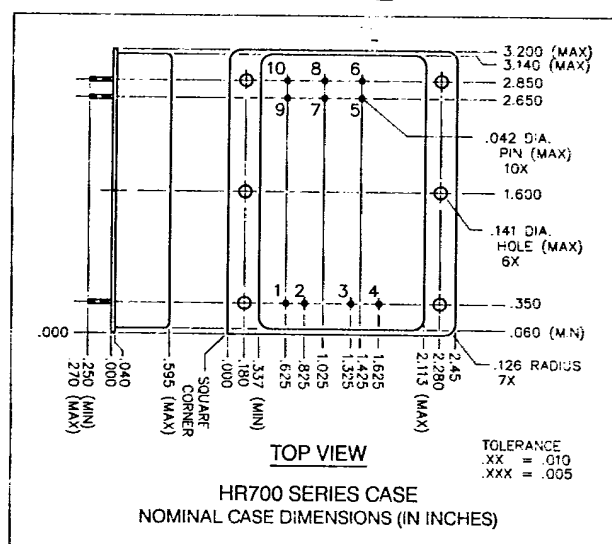
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### METAL HERMETIC PACKAGE



HR701-2805

HR701-2812

HR701-2815

HR702-2812

HR702-2815

HR703-2812

HR703-2815

|                                          | SINGLE  | DUAL    | TRIPLE  |
|------------------------------------------|---------|---------|---------|
| DESIGNATION                              | PIN NO. | PIN NO. | PIN NO. |
| POSITIVE INPUT                           | 1       | 1       | 1       |
| INPUT COMMON                             | 3       | 3       | 3       |
| INHIBIT/SYNC INPUT                       | 4       | 4       | 4       |
| CASE GROUND                              | 2       | 2       | 2       |
| POSITIVE MAIN OUTPUT (+5, +12 or +15VDC) | 9, 10   | 6       | 9, 10   |
| POSITIVE AUX OUTPUT (+12 or +15VDC)      | N/A     | N/A     | 6       |
| NEGATIVE AUX OUTPUT (-12 or -15VDC)      | N/A     | 5       | 5       |
| MAIN OUTPUT COMMON                       | 7, 8    | 7, 8    | 7, 8    |
| AUX OUTPUT COMMON                        | N/A     | 7, 8    | 7, 8    |
| POSITIVE REMOTE SENSE                    | 6       | N/A     | N/A     |
| COMMON REMOTE SENSE                      | 5       | N/A     | N/A     |

CASE, PINS AND COVER: Cold Rolled Steel with Fused Tin Finish.

CAUTION: Heat from reflow or wave soldering may damage this converter. Solder this part one pin at a time with heat application NOT exceeding 300°C for 10 seconds per pin.

### TYPICAL PERFORMANCE CURVES

