## DC/DC CONVERTERS 12 & 28 VOLT INPUT

## NOT RECOMMENDED FOR NEW DESIGNS

## **FEATURES**

- –40°C to +85°C operation
- 10 to 16 VDC input or 18 to 36 VDC input
- Fully Isolated
- Optocoupler feedback
- Fixed frequency, 125 kHz typical single and dual outputs; 250 kHz typical triple outputs
- Transient protection 50 V for up to 50 ms 28 Vin models
- Inhibit function
- · Indefinite short circuit protection
- · Up to 86% efficiency
- Output trim on single output models



MODELS VDC OUTPUT								
SINGLE 5 12	DUAL ±12 ±15	TRIPLE +5 & ±12 +5 & ±15						
15								

Size (max.): HR151 and 152 models, case H6 2.125 x 1.125 x 0.495 inches (53.98 x 28.58 x 12.57 mm) HR153 models, case F4 1.950 x 1.350 x 0.505 inches (49.53 x 34.29 x 12.83 mm) See cases F4 and H6 for dimensions. Weight: HR151 and 152: 50 grams typical. HR153: 53 grams typical. Screening: Standard only. See "HR Industrial Non-QML Products – Environmental Screening" table for screening description.

## DESCRIPTION

The HR150 Series<sup>™</sup> DC/DC converters have been designed to give industrial applications the same high reliability, small size, and high performance that Interpoint has provided to military and aerospace programs since 1969.

### HIGH RELIABILITY

Each HR150 converter is built to perform reliably in the harshest environments. Assembled using thick-film hybrid technology, HR150 converters have more uniform thermal coefficients and 50% fewer connections than converters built by surface mount techniques. The HR150 converter 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 10-3 atm-cc/sec. All devices are 100% electrically tested.

## SMALL SIZE - LOW PROFILE

The HR150 Series manufacturing techniques provide extremely small size and low profile components. Each converter uses less than 2.7 square inches of board area. The overall power density is from 11 to 17 watts per cubic inch.

## HIGH PERFORMANCE

The HR150 Series converters are high efficiency, low noise, pulse width modulated, forward mode switching regulators with a constant switching frequency of 125 kHz typical for single and dual output

models and 250 kHz typical for triple output models. They achieve high isolation (500 V, 100 megohm) through use of a transformer in the forward power circuit and an opto-coupler in the feedback control loop.

HR 150 Series input ranges are 10 to 16 VDC or 18 to 36 VDC. Outputs are available as 5, 12, 15,  $\pm$ 12,  $\pm$ 15,  $\pm$ 5 &  $\pm$ 12, and  $\pm$ 5 &  $\pm$ 15 VDC. The converters typically provide greater than 80% efficiency over the entire input range and from 25% to full load. Line regulation is typically within 0.1 % and load regulation within 0.2%.

HR150 converters are designed to operate between -40°C and +85°C case and are short circuit protected up to a case temperature of 85°C. The combination of high conversion efficiency and heat dissipating metal enclosures minimizes heat sinking requirements. If additional dissipation is desired, heat conducting material (PCB, copper sheet, heat sink, etc.) may be brought into contact with the unit's baseplate.

An inhibit function is provided for HR150 converters when the inhibit input pin is connected to the input common. The open circuit voltage of the inhibit input pin is 8 to 10 VDC (Vin = 12) or 11 to 13 VDC (Vin = 28). The inhibit input pin must sink approximately 1 mA during the inhibit state. During inhibit, the converter's output voltage drops to less than 1 volt and the input current is typically 8 mA.



ABSOLUTE MAXIMUM RATINGS	TYPICAL CHARACTERISTICS
Input Voltage	Output Voltage Temperature Coefficient
<ul> <li>10 to 16 VDC HR15X-12XX</li> </ul>	<ul> <li>150 ppm/°C, typical</li> </ul>
<ul> <li>18 to 36 VDC HR15X-28XX</li> </ul>	Input to Output Capacitance
Output Power	• 60 pF, typical
<ul> <li>15 watts (HR151-2812 &amp; HR151-2815, 20 watts)</li> </ul>	Isolation
Lead Soldering Temperature (10 sec)	<ul> <li>100 megohm minimum at 500 V</li> </ul>
• 300°C	Conversion Frequency
Storage Temperature Range (Case)	• 250 kHz
• –55°C to +125°C	Inhibit Pin Voltage (unit enabled)
	• 8 to 10 V HR15X-12XX models
RECOMMENDED OPERATING CONDITIONS	<ul> <li>11 to 13 V HR15X-28XX models</li> </ul>
Input Voltage Range	Line Regulation
<ul> <li>10 to 16 VDC continuous HR15X-12XX models</li> </ul>	• 0.1% typical, 0.2% maximum
<ul> <li>18 to 36 VDC continuous HR15X-28XX models</li> </ul>	Load Regulation
<ul> <li>50 V/50 ms transient HR15XX-28XX models</li> </ul>	• 0.2% typical, 0.4% maximum
Case Operating Temperature (Tc)	
• -40°C to +85°C full power	INHIBIT
<ul> <li>-40°C to +105°C absolute</li> </ul>	Inhibit TTL Open Collector
Derating Output Power/Current	Logic low (output disabled)
<ul> <li>Linearly from 100% at 85°C to 0% at 105°C</li> </ul>	Inhibit pin current 1 mA typical
for HR151 models	Inhibited input current 8 mA typical
<ul> <li>Linearly from 100% at 85°C to 0% at 115°C</li> </ul>	Referenced to input common
for HR153 models	Logic high (output enabled)
	Open collector

## Electrical Characteristics: 25°C Tc, 28 VDC Vin (12 Vin for 12V models), 100% load, unless otherwise specified.

SINGLE OUTPUT N	MODELS, 12 V IN	HR151-1205			HR151-1212			HR151-1215			UNITS
PARAMETER	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	onno
OUTPUT VOLTAGE		4.90	5.0	5.05	11.88	12	12.12	14.85	15	15.15	VDC
OUTPUT CURRENT		-	-	3.0	-	—	1.25	_	—	1.0	А
OUTPUT POWER		-	-	15	-	-	15	_	_	15	W
OUTPUT RIPPLE	0 TO 1 MHz	-	35	70	-	35	70	_	35	70	mV p-p
INPUT VOLTAGE	CONTINUOUS	10	12	16	10	12	16	10	12	16	VDC
INPUT CURRENT	NO LOAD	-	-	24	-	—	32	_	—	32	mA
INPUT RIPPLE CURRENT	0 TO 2 MHz	-	40	80	-	40	80	_	40	80	mA p-p
EFFICIENCY		75	81	_	76	82	_	77	83	_	%

SINGLE OUTPUT N		HR151-2805			u	3151-2	210	u	3151-28		
SINGLE COTFOTIN	,				111			111	1151-20		UNITS
PARAMETER	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
OUTPUT VOLTAGE		4.90	5.0	5.05	11.88	12	12.12	14.85	15	15.15	VDC
OUTPUT CURRENT		-	—	3.0	_	—	1.667	_	—	1.333	А
OUTPUT POWER		-	—	15	—	_	20	—	—	20	W
OUTPUT RIPPLE	0 to 1 MHz	—	30	60	—	40	80	—	40	80	mV p-p
INPUT VOLTAGE	CONTINUOUS	18	28	36	18	28	36	18	28	36	VDC
	TRANSIENT 50 ms	_	-	50	_	-	50	_	-	50	V
INPUT CURRENT	NO LOAD	-	-	20	_	_	30	_	—	30	mA
INPUT RIPPLE CURRENT	0 TO 2 MHz	-	25	50	_	25	50	_	25	50	mA p-p
EFFICIENCY		75	81	-	76	82	-	77	83	-	%



Electrical Characteristics: 25°C Tc, 28 VDC Vin (12 VDC for 12V models), 100% load, unless otherwise specified.

DUAL OUTPUT	AL OUTPUTS			2	HR1			
PARAMETER	CONDITION	MIN	TYP	MAX	MIN	TYP	MAX	UNITS
OUTPUT VOLTAGE		±11.88	±12.00	±12.12	±14.85	±15.00	±15.15	VDC
OUTPUT CURRENT		0	_	±625	0	_	±500	mA
OUTPUT POWER		_	_	15	_	_	15	W
OUTPUT RIPPLE	0 TO 1 MHz	_	30	50	_	30	50	mV p-p
INPUT VOLTAGE	CONTINUOUS TRANSIENT 50 ms	18	28	36 50	18	28	36 50	VDC V
INPUT CURRENT	NO LOAD	_	_	35	_	_	35	mA
INPUT REFL. RIPPLE	0 TO 2 MHz	-	25	50	_	25	50	mA p-p
EFFICIENCY		75	79	-	75	79	-	%

TRIPLE OUT		S	HR	153-1	212	HF	153-1	215	HR	153-2	812	HR	153-2	815	UNITS
PARAMETER	CONDIT	IONS	MIN	TYP	MAX	onno									
OUTPUT VOLTAGE	FULL	MAIN	4.95	5.00	5.05	4.95	5.00	5.05	4.95	5.00	5.05	4.95	5.00	5.05	VDC
	LOAD	DUAL	±11.88	±12	±12.12	±14.85	±15	±15.15	±11.88	±12	±12.12	±14.85	±15	±15.15	
OUTPUT CURRENT	MAIN	1	100	_	2000	100	_	2000	100	_	2000	100	_	2000	mA
	DUAI	L	_	_	±208	_	_	±167	_	_	±208	_	_	±167	
OUTPUT POWER	MAIN	1	_	_	10	_	_	10	_	_	10	_	_	10	W
	±DUA	L	_	_	2.5	_	_	2.5	_	_	2.5	_	_	2.5	
	τοτα	L	_	_	15	_	_	15	_	_	15	-	_	15	
OUTPUT RIPPLE	0 то 1 MHz	MAIN	_	40	80	_	40	80	_	40	80	_	40	80	mV p-p
	0.001.0012	DUAL	_	20	40	_	20	40	_	20	40	_	20	40	
INPUT VOLTAGE	CONTINU	JOUS	10	22	16	10	22	16	18	28	36	18	28	36	VDC
	TRANSIENT	50 ms	] _	_	25	_	_	25	_	_	50	_	_	50	V
INPUT CURRENT	NO LO	AD	_	_	60	_	_	60	_	_	50	_	_	50	mA
INPUT REFL. RIPPLE	0 то 2 І	MHz	_	50	100	_	50	100	_	40	80	_	40	80	mA p-p
EFFICIENCY			76	79	_	76	79	_	75	79	_	75	79	_	%

#### Notes

1. Minimum load required for full output capability on auxiliary outputs. Minimum current can be reduced when dual outputs are used at reduced loads.

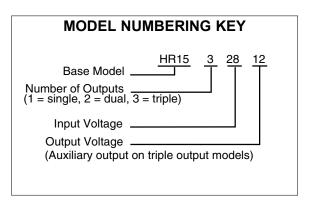


		PIN OUT					
Pin	Single Output	Dual Output	Trip	le Outp	out		
1	Positive Input	Positive Input	Posit	tive Inpu	ut		
2	Inhibit	Inhibit	Main	(+5) O	utput		
3	Trim	Positive Output	Outp	ut Com	mon		
4	Output Common	Output Common	Neg.	Aux. O	utput		
5	Positive Output	Negative Output	Pos.	Aux. O	utput		
6	No connection	No connection	No c	onnecti	on		
7	No connection	No connection	Case	Groun	d		
8	Case Ground	Case Ground	Inhib	it			
9	No connection	No connection	No connection		No connection		
10	Input Common	Input Common	Input Common				
C Dot on top of package	indicates pin one			•	ate pin o	•	
$ \bigcirc \qquad \bigcirc $	$\left[ \begin{array}{c} \bullet \\ 4 \end{array} \right] $		1	2	3	4	5
BOTTOM HR151 and I				BO	TTOM VI HR153	EW	
10 9 8	7 6		10	9	8	7	6
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See case H6 for dimensions.				0.0250	F4 for di	mensior	ıs.
See case H6 for di	mensions.		36	e case	1 4 101 01	1110113101	

### OUTPUT ADJUSTMENT RESISTOR VALUES FOR HR151-2805

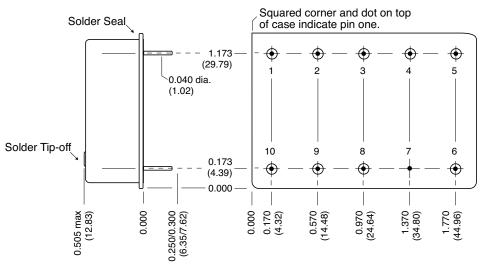
Resistance Pin 3 to 4	Output Voltage Increase (%)
∞	0
390K	+1%
145K	+2%
63K	+3%
22K	+4%
0	+5%

Output Adjustment all HR151 models (single output): The output can be adjusted upward by using the output adjust (pin3). The resistance between output adjust (pin 3) and output common (pin 4) will determine the magnitude of the increase in the output. The table above is only applicable to HR151-2805.





## BOTTOM VIEW CASE F4 MTO Series and HR153 Series



Seal hole: 0.083 ±0.003 (2.11 ±0.08)

#### Case dimensions in inches (mm)

Tolerance  $\pm 0.005$  (0.13) for three decimal places  $\pm 0.01$  (0.3) for two decimal places unless otherwise specified

#### CAUTION

Heat from reflow or wave soldering may damage the device. Solder pins individually with heat application not exceeding 300°C for 10 seconds per pin.

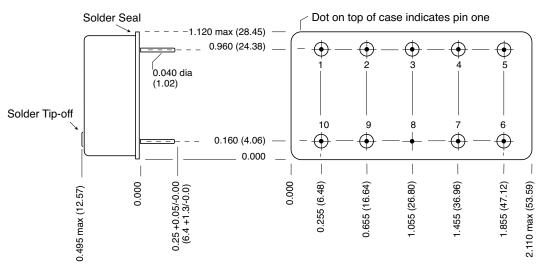
Case F4, Rev B, September 21, 2005

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FIGURE 3: CASE F4 - HR153



## BOTTOM VIEW CASE H6



### 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/Tin
Cover	Cold Rolled Steel/Nickel/Tin
Pins	#52 alloy, compression glass seal or ceramic seal

Case H6, Rev C, 20060802

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FIGURE 4: CASE H6 - HR151 AND HR152



## HR INDUSTRIAL NON-QML PRODUCTS – ENVIRONMENTAL SCREENING

TEST	HR Industrial STANDARD non QML <sup>1</sup>
Pre-cap Inspection	
Method 2017	yes
Final Electrical Test MIL-PRF-38534, Group A	
Subgroups 1 and 4: +25°C case	yes
Hermeticity Test	
Gross Leak, Dip (1 x 10 <sup>-3</sup> )	yes
Final Visual Inspection	
Method 2009	yes

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

Notes:

1. Non-QML products do not meet all of the requirements of MIL-PRF-38534

