

FEATURES

- **-40°C to +85°C operation**
- **16 to 32 VDC input voltage**
- Fully isolated
- Opto-coupler feedback
- Switching frequency
Single and dual outputs
typical 80 kHz, variable freq.
Triple output 200 kHz, fixed
- Topology – Flyback
- Inhibit function
- Indefinite short circuit protection
- Up to 75% efficiency
- **Requires external capacitors**

DC/DC CONVERTERS 28 VOLT INPUT

HR40 SERIES 4 WATT



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

Size (max.): 1.075 x 1.075 x 0.370 inches (27.31 x 27.31 x 9.40 mm)
See Section B8, case C2, for dimensions.
Weight: 20 grams maximum
Screening: Standard only. See Section C2 for screening description.

DESCRIPTION

The HR40 Series™ DC/DC converters offer the high efficiencies associated with switching regulators, yet have full isolation of input and output grounds. The units are built using thick-film hybrid technology and are sealed in metal packages for high-reliability applications. All models are guaranteed to pass a gross leak test (maximum leak rate of 1×10^{-3} atm-cc/sec).

The HR40 Series devices are flyback energy storage switching regulators which require a minimum of components resulting in small package size. Single and dual models self-oscillate at an operating frequency which is an approximate inverse function of the load. At full load, the frequency is typically 80 kHz for single and dual output models. Triple output models operate at a fixed frequency of approximately 200 kHz. A transformer in the forward power circuit and an opto-coupler in the feedback/control loop maintain input to output isolation.

Models are available with single 5 volt, dual 12 or 15 volt, or triple (+5 and either ±12 or ±15) outputs with an input voltage range of 16 to 32 VDC. Output power of up to 4 watts is available from the dual output models for either balanced or unbalanced loads; however, at least 25% of the total load should be on the positive output. The single output device can provide 3.5 watts, and the triple output can supply up to 3.2 watts. The high efficiency is almost constant over the entire input voltage range and from approximately 25% of full load to full load. This makes the unit ideal for battery applications.

An open collector TTL inhibit is provided to allow power shutdown and startup from a logic input. An open circuit on the inhibit terminal (pin 15) gives normal operation, and a TTL low level shuts down the converter. The inhibit pin has an open circuit voltage of 12 to 28 V. Input current in the shutdown mode will be less than 15 mA. Current limiting is provided on each output for indefinite short circuit protection.

Due to the high efficiency, heat sinking requirements are minimized, but consideration should be given to removing self-generated heat when operating these devices at maximum ratings. To increase dissipation, heat conducting material (PCB, copper sheet, heat sink, etc.) should be brought into contact with the converter's baseplate. The converter can be operated at full load at a case temperature of 85°C, with the output power derated linearly to zero at 105°C.

WARNING: EXTERNAL CAPACITORS REQUIRED

External capacitors are required on the outputs. **Operating the unit without external capacitors will result in damage to the internal circuitry.** Minimum recommended capacitor values are given in Tables 1 and 2. For optimum performance, low ESR (Equivalent Series Resistance) solid tantalum capacitors are required. The specifications on the following pages are based on the use of high-quality solid tantalums. Operation with different types of capacitors will seriously affect performance.

CRANE

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HR40 SERIES 4 WATT

DC/DC CONVERTERS

ABSOLUTE MAXIMUM RATINGS

Input Voltage

- 16 to 32 VDC

Output Power

- 3.2 to 4 watts depending on model

Lead Soldering Temperature (10 sec)

- 300°C

Storage Temperature Range (Case)

- -40°C to +125°C

INHIBIT

Inhibit TTL Open Collector

- Logic low (output disabled) ≤ 0.8 V
- Referenced to input common
- Logic high (output enabled) ≥ 12 V

RECOMMENDED OPERATING CONDITIONS

Input Voltage Range

- 16 to 32 VDC continuous
- 40 V for 50 ms transient

Case Operating Temperature (Tc)

- -40°C to +85°C full power
- -40°C to +105°C absolute

Derating Output Power/Current

- Linearly from 100% at 85°C to 0% at 105°C

TYPICAL CHARACTERISTICS

Output Voltage Temperature Coefficient

- HR41-2805 100 ppm/°C typ, 200 max.
- HR42-28XX 50 ppm/°C typ.
- HR43-28XX 100 ppm/°C typ.

Input to Output Capacitance

- 60 pF typical

Isolation

- 100 megohm minimum at 500 V

Conversion Frequency

- Single and dual output models, 80 kHz at full load typical, variable frequency
- Triple output models, 200 kHz typical fixed frequency

Inhibit Pin Voltage (unit enabled)

- 12 to 28 V

WARNING: EXTERNAL CAPACITORS REQUIRED

Electrical Characteristics: 25°C Tc, 28 VDC Vin, 100% load, unless otherwise specified.

| SINGLE AND DUAL OUTPUT MODELS | | HR41-2805 | | | HR42-2812 | | | HR42-2815 | | | UNITS |
|-------------------------------|--|-----------|-----|------|-----------|-----|--------|-----------|-----|--------|--------|
| PARAMETER ¹ | CONDITIONS | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | |
| OUTPUT VOLTAGE | P _{OUT} = 2 W | 4.90 | 5.0 | 5.10 | ±11.88 | ±12 | ±12.12 | ±14.85 | ±15 | ±15.15 | VDC |
| OUTPUT CURRENT | 18 TO 32 V _{IN} | — | — | 700 | — | — | ±167 | — | — | ±133 | mA |
| OUTPUT POWER ² | Tc = -40°C TO +85°C | — | — | 3.5 | — | — | 4.0 | — | — | 4.0 | W |
| OUTPUT RIPPLE | BW = 1 MHz | — | 75 | 150 | — | 75 | 150 | — | 75 | 150 | mV p-p |
| LINE REGULATION | 18 - 32 V _{IN} , P _{OUT} = 2 W | — | 5 | 10 | — | 10 | 20 | — | 10 | 20 | mV |
| LOAD REGULATION | NO LOAD TO FULL | — | 25 | 50 | — | 12 | 24 | — | 12 | 24 | mV |
| INPUT VOLTAGE | Tc = -40°C TO +85°C | 16 | 28 | 32 | 16 | 28 | 32 | 16 | 28 | 32 | VDC |
| | TRANSIENT 50 ms | — | — | 40 | — | — | 40 | — | — | 40 | V |
| INPUT CURRENT | NO LOAD | — | 7 | 10 | — | 10 | 15 | — | 10 | 15 | mA |
| | FULL LOAD | — | — | 192 | — | — | 213 | — | — | 213 | |
| | INHIBITED | — | — | 15 | — | — | 15 | — | — | 15 | |
| EFFICIENCY | FULL LOAD | 68 | 72 | — | 70 | 75 | — | 70 | 75 | — | % |

Notes

- External capacitors required to prevent damage to internal circuitry (see Table 1 for specifications).
- Dual output models deliver up to 4 watts total for balanced or unbalanced loads, however, the positive output should carry at least 25% of the total load.

SINGLE AND DUAL OUTPUT EXTERNAL CAPACITORS OPERATION WITHOUT EXTERNAL CAPACITORS WILL RESULT IN DAMAGE TO THE INTERNAL CIRCUITRY.

TABLE 1: EXTERNAL CAPACITOR REQUIREMENTS

| Model | Required Connection | Minimum Capacitor Value ¹ |
|---|---|--------------------------------------|
| Single Output HR41-2805 | Positive Output (12 & 13) to Output Common (8 & 9) | 220 µF, 10 V |
| Dual Outputs ² HR42-2812 and HR42-2815 | Positive Output (10) to Output Common (8) | 100 µF, 25 V |
| | External Capacitor (14) to Output Common (8) ³ | 100 µF, 25 V |
| | Negative Output (12) to Output Common (8) | 10 µF, 25 V |

Table 1 Notes

- Capacitors should be high quality, low ESR components — solid tantalum is recommended.
- See Figure 1 for connection diagram
- Place positive side of capacitor toward pin 8.

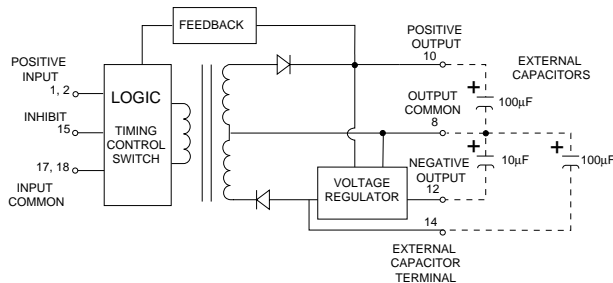


FIGURE 1: DUAL OUTPUT EXTERNAL CAPACITOR CONNECTIONS

DC/DC CONVERTERS

HR40 SERIES 4 WATT

WARNING: EXTERNAL CAPACITORS REQUIRED

Electrical Characteristics: 25°C Tc, 28 VDC Vin, 100% load, unless otherwise specified.

| TRIPLE OUTPUT MODELS | | | HR43-2812 | | | HR43-2815 | | | UNITS |
|-----------------------------|--|-------|-----------|-------|-------|-----------|-------|-------|--------|
| PARAMETER ¹ | CONDITIONS | | MIN | TYP | MAX | MIN | TYP | MAX | |
| OUTPUT VOLTAGE | P _{OUT} = 2 W BALANCED LOAD | MAIN | 4.9 | 5.0 | 5.1 | 4.9 | 5.0 | 5.1 | VDC |
| | | AUX | ±11.5 | ±12.0 | ±12.5 | ±14.5 | ±15.0 | ±15.5 | |
| OUTPUT CURRENT ² | 18 TO 32 V _{IN} | MAIN | 10.0 | — | 400 | 10.0 | — | 400 | mA |
| | | AUX | — | — | ±50.0 | — | — | ±40.0 | |
| OUTPUT POWER | Tc = -40°C TO +85°C | | — | — | 3.2 | — | — | 3.2 | W |
| OUTPUT RIPPLE | BW DC TO 1 MHz | MAIN | — | 50 | 100 | — | 50 | 100 | mV p-p |
| | | ± AUX | — | 50 | 100 | — | 50 | 100 | |
| LINE REGULATION | P _{OUT} = 2 W 18 TO 32 V _{IN} | MAIN | — | 5 | 10 | — | 5 | 10 | mV |
| | | ± AUX | — | 3 | 6 | — | 3 | 7.5 | |
| LOAD REGULATION | NO LOAD TO FULL | MAIN | — | 15 | 30 | — | 15 | 30 | mV |
| | | ± AUX | — | 15 | 30 | — | 12 | 24 | |
| INPUT VOLTAGE | Tc = -40°C TO +85°C | | 16 | 28 | 32 | 16 | 28 | 32 | VDC |
| | TRANSIENT 50 ms | | — | — | 40 | — | — | 40 | V |
| INPUT CURRENT | NO LOAD | | — | 10 | 20 | — | 10 | 20 | mA |
| | FULL LOAD | | — | — | 176 | — | — | 176 | |
| | INHIBITED | | — | — | 15 | — | — | 15 | |
| EFFICIENCY | FULL LOAD | | 68 | 70 | — | 68 | 70 | — | % |

Notes

- External capacitors required to prevent damage to internal circuitry
- Minimum load required on main output for full power auxiliary operation. (see Table 2 for specifications).

TRIPLE OUTPUT EXTERNAL CAPACITOR
OPERATION WITHOUT EXTERNAL CAPACITORS WILL RESULT IN DAMAGE TO THE INTERNAL CIRCUITRY.

TABLE 2: EXTERNAL CAPACITOR REQUIREMENTS

| Model | Required Connection ¹ | Minimum Capacitor Value ² |
|-------------------------|---|--------------------------------------|
| HR43-2812 and HR43-2815 | Positive 5 VDC Output (9) to Output Common (6 or 7) | 220 µF, 10 V |

Table 2 Notes
 1. See Figure 2 for connection diagram.
 2. Capacitors should be high quality, low ESR components — solid tantalum is recommended.

**FIGURE 2:
TRIPLE OUTPUT EXTERNAL CAPACITOR CONNECTIONS**

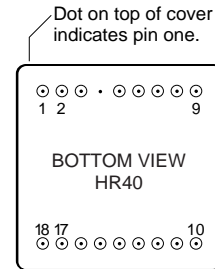
HR40 SERIES 4 WATT

DC/DC CONVERTERS

**WARNING: EXTERNAL CAPACITORS REQUIRED
OPERATION WITHOUT EXTERNAL CAPACITORS WILL RESULT IN DAMAGE TO THE INTERNAL CIRCUITRY.**

PIN OUT

| Pin | Single Output | Dual Output | Triple Output |
|---------------------|------------------------------|-----------------|---------------------------------|
| 1, 2 ¹ | Positive Input | Positive Input | Positive Input |
| 3 | No connection | No connection | No connection |
| 4 | Case | Case | Case |
| 5 | No connection | No connection | Negative Aux. Output |
| 6 | No connection | No Connection | Output Common Main ² |
| 7 | No connection | No connection | Output Common Aux. ² |
| 8 | Output Common ³ | Output Common | Positive Aux. Output |
| 9 | Output Common ³ | No connection | +5 VDC Output |
| 10 | No connection | Positive Output | No connection |
| 11 | No connection | No connection | No connection |
| 12 | Positive Output ³ | Negative Output | No connection |
| 13 | Positive Output ³ | No connection | No connection |
| 14 | No connection | Ext. Capacitor | No connection |
| 15 | Inhibit | Inhibit | Inhibit |
| 16 | No connection | No connection | No connection |
| 17, 18 ¹ | Input Common | Input Common | Input Common |



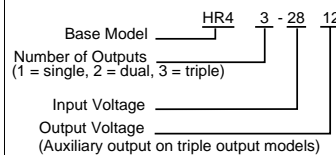
See Section B8. case C2, for dimensions

FIGURE 3: PIN OUT

Pin Out Notes

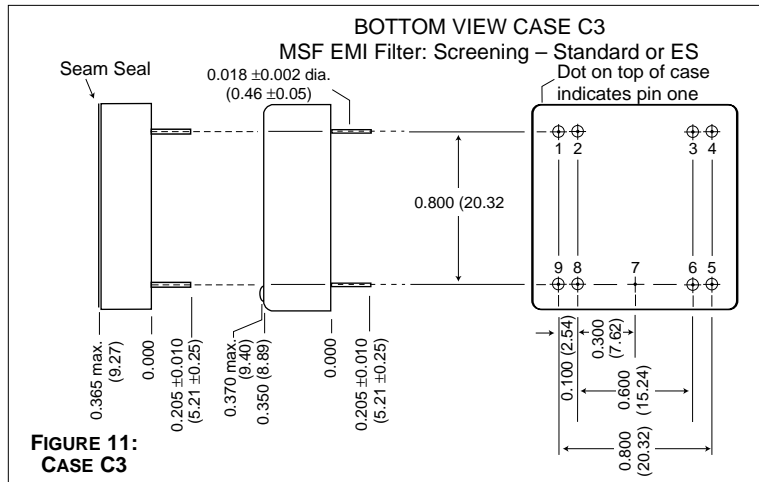
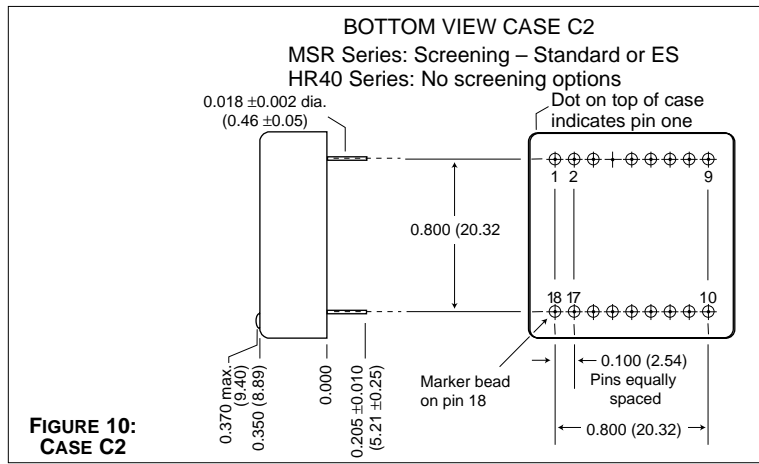
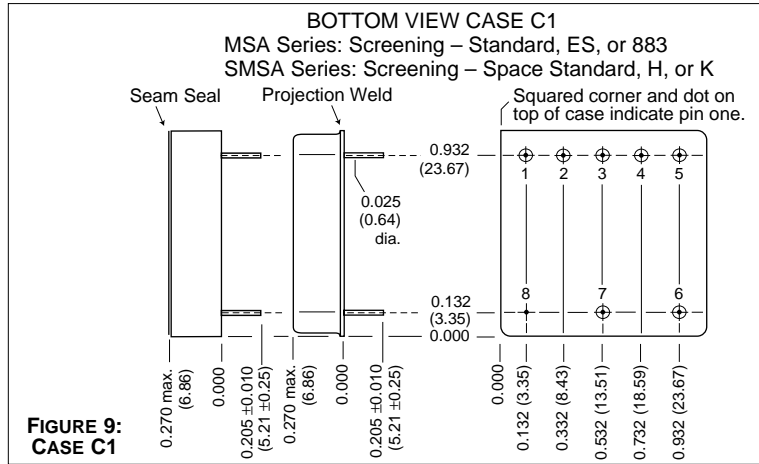
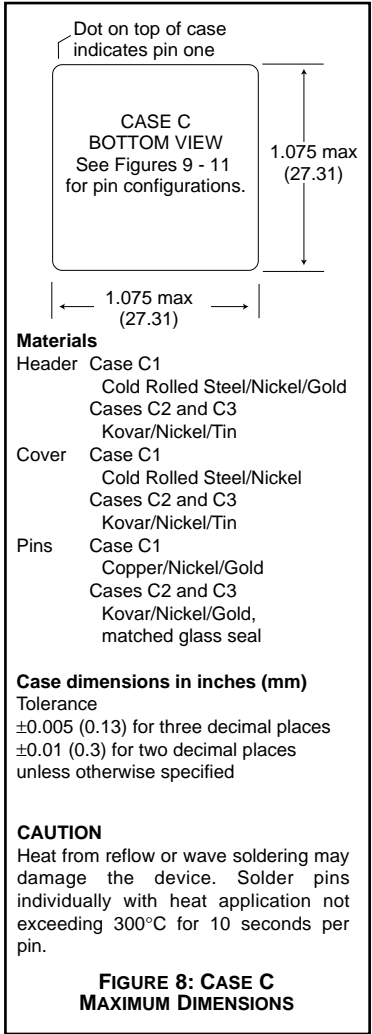
- Make external connection to both pins on all models.
Pins 1 and 2 positive input
Pins 17 and 18 input common
- Pins 6 and 7 on triple output models are connected internally.
- On the HR41-2805:
Make external connections to both output common pins (8 and 9).
Make external connections to both positive output pins (12 and 13).

MODEL NUMBERING KEY



CASE C

CASES



Note: Although every effort has been made to render the case drawings at actual size, variations in the printing process may cause some distortion. Please refer to the numerical dimensions for accuracy.

HR PRODUCTS

| TEST (HR products) | STANDARD |
|---|----------|
| PRE-CAP INSPECTION Method 2017 | yes |
| FINAL ELECTRICAL TEST MIL-PRF-38534, Group A Subgroups 1 and 4: +25°C case | yes |
| HERMETICITY TESTING Gross Leak, Dip (1×10^{-3}) | yes |
| FINAL VISUAL INSPECTION Method 2009 | yes |

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

Applies to the following products:

HR700 Series
HR300 Series
HR150 Series
HR120 Series
HR40 Series