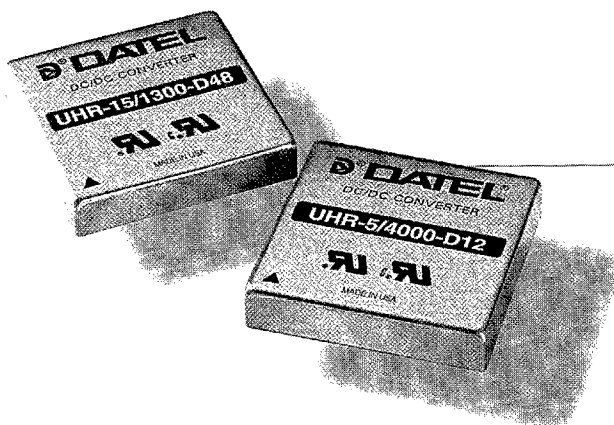




## Single Output Ruggedized, 2" x 2" 16-20 Watt, DC/DC Converters

DATEL's XHR Series DC/DC converters deliver a measure of cost-effective long-term reliability not previously available in commercial, off-the-shelf power converters. These DC/DC's combine the high-efficiency and wide-input-range of DATEL's venerable XWR Series DC/DC's with a newly developed, all metal-ceramic, construction technique that eliminates the need for thermally-conductive potting compounds.

All electrical components are surface-mount soldered to a 60 mil (0.06"/1.52mm) ceramic baseplate for low junction-to-case thermal resistance. Package pins, instead of traditional butt soldering, are soldered through the baseplate via pre-cut holes. Pre-cutting prior to firing, as opposed to laser cutting after firing, eliminates micro cracks. The tin plated, steel cover is soldered to the baseplate creating a level of hermiticity not available in other commercial power modules. The bottom of the baseplate has a conductive layer that provides 6-sided shielding. It is also insulated so pc-card runs can pass beneath the package.

UHR Models are the single-output devices in the XHR Series. They offer outputs of 3.3, 5, 12 or 15 Volts. The ultra-wide (4:1) input voltage ranges are either 9-36V ("D12" models) or 18-72V ("D48" models). Line and load regulation are a tight  $\pm 0.3\%$  max. and  $\pm 0.5\%$  max., respectively. All devices guarantee that output ripple/noise will be less than 100mVp-p. Isolation voltage is guaranteed to be at least 750Vdc.

UHR devices carry industry-standard pinouts in packages whose outside dimensions are only slightly larger than the 2" x 2" standard. They can be subjected to mutually-agreed-upon, high-rel screening programs as necessary to satisfy your system's reliability requirements. Contact DATEL for additional details.

### Features

- Ruggedized design
- All metal-ceramic construction
- Low junction-to-baseplate thermal impedance
- No potting compounds
- 3.3, 5, 12 or 15 Volt outputs
- Ultra-wide input voltage ranges: 9-36V or 18-72V
- Industry-standard pinouts
- No external components required
- Tight regulation, low ripple/noise
- Guaranteed efficiencies to 82%
- $V_{OUT}$  trim and on/off control
- Modifications and customs for OEM's

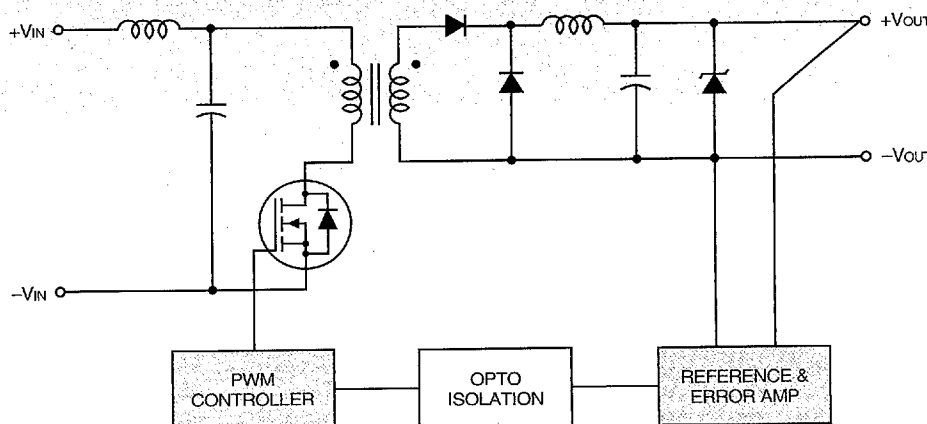


Figure 1. Simplified Schematic

Performance Specifications and Ordering Guide <sup>①</sup>

| Model            | OUTPUT                   |                             |                                         |                   |       | INPUT                        |               |                                         | Efficiency (Min.) | Package (Case, Pinout) |
|------------------|--------------------------|-----------------------------|-----------------------------------------|-------------------|-------|------------------------------|---------------|-----------------------------------------|-------------------|------------------------|
|                  | V <sub>out</sub> (Volts) | I <sub>out</sub> (mA, Max.) | Ripple/Noise <sup>②</sup> (mVp-p, Max.) | Regulation (Max.) |       | V <sub>in</sub> Nom. (Volts) | Range (Volts) | I <sub>in</sub> <sup>④</sup> (mA, Max.) |                   |                        |
| UHR-3.3/4850-D12 | 3.3                      | 4850                        | 75                                      | ±0.5%             | ±1.0% | 24                           | 9-36          | 45/916                                  | 75%               | C8, P6                 |
| UHR-3.3/4850-D48 | 3.3                      | 4850                        | 100                                     | ±1.0%             | ±1.0% | 48                           | 18-72         | 25/440                                  | 78%               | C8, P6                 |
| UHR-5/4000-D12   | 5                        | 4000                        | 100                                     | ±0.3%             | ±0.5% | 24                           | 9-36          | 25/1060                                 | 79%               | C8, P6                 |
| UHR-5/4000-D48   | 5                        | 4000                        | 100                                     | ±0.3%             | ±0.5% | 48                           | 18-72         | 25/526                                  | 80%               | C8, P6                 |
| UHR-12/1650-D12  | 12                       | 1650                        | 100                                     | ±0.3%             | ±0.5% | 24                           | 9-36          | 30/1050                                 | 81%               | C8, P6                 |
| UHR-12/1650-D48  | 12                       | 1650                        | 100                                     | ±0.3%             | ±0.5% | 48                           | 18-72         | 25/514                                  | 81%               | C8, P6                 |
| UHR-15/1300-D12  | 15                       | 1300                        | 100                                     | ±0.3%             | ±0.5% | 24                           | 9-36          | 30/1000                                 | 82%               | C8, P6                 |
| UHR-15/1300-D48  | 15                       | 1300                        | 100                                     | ±0.3%             | ±0.5% | 48                           | 18-72         | 30/495                                  | 82%               | C8, P6                 |

① Typical at T<sub>A</sub> = +25°C under nominal line voltage and full-load conditions, unless otherwise noted.

② Ripple/Noise (R/N) measured over a 20MHz bandwidth.

③ 20% to 100% load.

④ Nominal line voltage, no-load/full-load conditions.

## PART NUMBER STRUCTURE

**U HR - 5 / 4000 - D12**

## Output Configuration:

U = Unipolar

## Input Voltage Range:

D12 = 9-36 Volts (24V nominal)

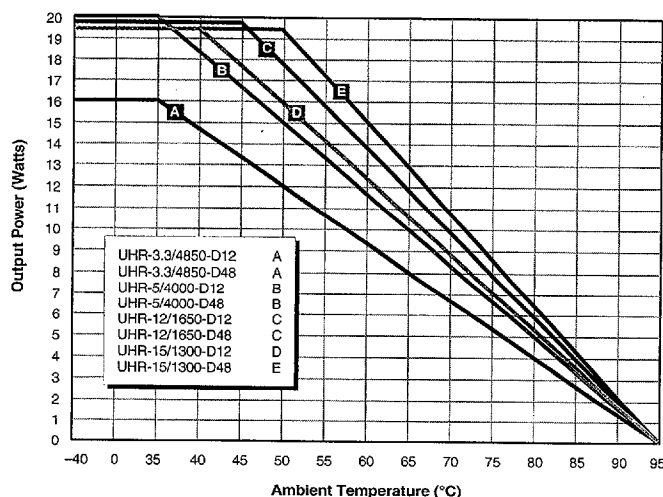
D48 = 18-72 Volts (48V nominal)

Metal-Ceramic Construction  
Wide Range Input

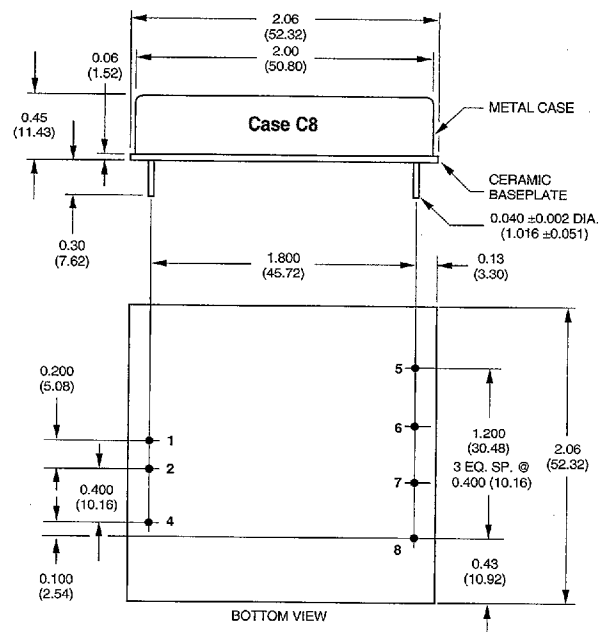
Nominal Output Voltage:  
3.3, 5, 12 or 15 Volts

Maximum Output Current  
in mA

## TEMPERATURE DERATING



## MECHANICAL SPECIFICATIONS



## I/O Connections

| Pin | Function       |
|-----|----------------|
| 1   | +Input         |
| 2   | -Input         |
| 3   | No Pin         |
| 4   | On/Off Control |
| 5   | No Pin         |
| 6   | +Output        |
| 7   | Common         |
| 8   | Trim           |

## Notes:

For "D12" models,  
the case is connected to  
pin 2 (-V<sub>in</sub>).

For "D48" models, the case  
is connected to pin 1 (+V<sub>in</sub>).

## Performance/Functional Specifications

Typical @ T<sub>A</sub> = +25°C under nominal line voltage and full load conditions unless noted. ①

| INPUT                                      |                                          |
|--------------------------------------------|------------------------------------------|
| <b>Input Voltage Range:</b>                |                                          |
| "D12" Models                               | 9-36 Volts (24V nominal)                 |
| "D48" Models                               | 18-72 Volts (48V nominal)                |
| <b>Input Current</b>                       | See Ordering Guide                       |
| <b>Input Filter Type</b> ②                 | LC                                       |
| <b>Overshoot Shutdown:</b>                 |                                          |
| "D12" Models                               | 40 Volts                                 |
| "D48" Models                               | 76 Volts                                 |
| <b>Reverse-Polarity Protection</b>         | Yes (Instantaneous, 10A maximum)         |
| <b>On/Off (Sync) Control (Pin 4)</b> ③     | TTL high = off, low (or open) = on       |
| OUTPUT                                     |                                          |
| <b>V<sub>out</sub> Accuracy (50% load)</b> | ±1%, maximum                             |
| <b>Temperature Coefficient</b>             | ±0.02% per °C                            |
| <b>Ripple/Noise (20MHz BW)</b> ②           | See Ordering Guide                       |
| <b>Line/Load Regulation</b>                | See Ordering Guide                       |
| <b>Efficiency</b>                          | See Ordering Guide                       |
| <b>Isolation Voltage</b>                   | 750Vdc, minimum                          |
| <b>Isolation Capacitance</b>               | 550pF                                    |
| <b>Current Limiting</b>                    | Auto-recovery                            |
| <b>Overshoot Protection</b>                | Zener/transorb clamp, magnetic feedback  |
| DYNAMIC CHARACTERISTICS                    |                                          |
| <b>Transient Response (50% load step)</b>  | 200µsec max. to ±1.5% of final value     |
| <b>Switching Frequency</b>                 | 165kHz (±10kHz)                          |
| ENVIRONMENTAL                              |                                          |
| <b>Operating Temperature (Ambient):</b>    |                                          |
| Without Derating                           | -40 to +35/40/45/50°C (Model dependent)  |
| With Derating                              | to +95°C (See Derating Curves)           |
| Maximum Baseplate Temperature              | +95°C                                    |
| <b>Storage Temperature</b>                 | -55 to +125°C                            |
| PHYSICAL                                   |                                          |
| <b>Dimensions</b>                          | 2.06" x 2.06" x 0.45" (52 x 52 x 11.4mm) |
| <b>Shielding</b>                           | 6-sided                                  |
| <b>Case Connection:</b>                    |                                          |
| "D12" Models                               | Pin 2 (-V <sub>N</sub> )                 |
| "D48" Models                               | Pin 1 (+V <sub>N</sub> )                 |
| <b>Case Material:</b>                      |                                          |
| Cover                                      | Tin plated steel                         |
| Baseplate                                  | Ceramic (0.06"/1.52mm)                   |
| <b>Pin Material</b>                        | Brass, solder coated                     |
| <b>Weight</b>                              | 1.7 ounces (49.5 grams)                  |

① These converters require a minimum 20% loading to maintain specified regulation. Operation under no-load conditions will not damage these devices; however they may not meet all listed specifications.

② Application-specific input/output filtering can be recommended and perhaps added internally upon request. Contact DATEL Applications Engineering for details.

③ Applying a voltage to the Control pin when no input power is applied to the converter can cause permanent damage to the converter.

## ABSOLUTE MAXIMUM RATINGS

|                                             |                                                                          |
|---------------------------------------------|--------------------------------------------------------------------------|
| <b>Input Voltage:</b>                       |                                                                          |
| "D12" Models                                | 44 Volts                                                                 |
| "D48" Models                                | 80 Volts                                                                 |
| <b>Input Reverse-Polarity Protection</b>    | Current must be <10A. Brief duration only. Fusing recommended.           |
| <b>Output Overvoltage Protection:</b>       |                                                                          |
| 3.3V Outputs                                | No protection                                                            |
| 5V Outputs                                  | 6.8 Volts, limited duration                                              |
| 12V Outputs                                 | 15 Volts, limited duration                                               |
| 15V Outputs                                 | 18 Volts, limited duration                                               |
| <b>Output Current</b>                       | Current limited. Max. current and short-circuit duration model dependent |
| <b>Storage Temperature</b>                  | -55 to +125°C                                                            |
| <b>Lead Temperature (soldering, 10sec.)</b> | +300°C                                                                   |

These are stress ratings. Exposure of devices to any of these conditions may adversely affect long-term reliability. Proper operation under conditions other than those listed in the Performance/Functional Specifications Table is not implied.

## TECHNICAL NOTES

## Floating Outputs

All outputs are floating. Users may ground either the Common (pin 7) for normal usage or the positive side (+Output, pin 6) to effectively reverse the output polarity.

## Filtering and Noise Reduction

All UHR 16-20 Watt DC/DC Converters achieve their rated ripple and noise specifications without the use of external input/output capacitors. In critical applications, input/output noise may be further reduced by installing electrolytic capacitors across the input terminals and/or low-ESR tantalum or electrolytic capacitors across the output terminals. The caps should be located as close to the power converters as possible. Typical values are listed below. In many applications, using values greater than those listed will yield better results.

## To Reduce Input Ripple

|              |               |
|--------------|---------------|
| "D12" Models | 20µF, 50V     |
| "D48" Models | 20-50µF, 100V |

## To Reduce Output Ripple

|                |                    |
|----------------|--------------------|
| 3.3V Outputs   | 100µF, 6V, Low ESR |
| 5V Outputs     | 47µF, 10V, Low ESR |
| 12/15V Outputs | 22µF, 20V, Low ESR |

In critical, space-sensitive applications, DATEL may be able to tailor the internal input/output filtering of these units to meet your specific requirements. Contact our Applications Engineering Group for additional details.

### Input Fusing

Certain applications and/or safety agencies may require the installation of fuses at the inputs of power conversion components. For DATEL UHR 16-20 Watt DC/DC Converters, you should use slow-blow type fuses with values no greater than the following:

| $V_{IN}$ Range | Fuse Value |
|----------------|------------|
| "D12"          | 4A         |
| "D48"          | 2A         |

### On/Off Control

The On/Off Control pin (pin 4) may be used for remote on/off operation. A TTL logic high (+2 to +5 Volts, 250 $\mu$ A max.) applied to pin 4 disables the converter. A TTL logic low (0 to +0.8 Volts, 70 $\mu$ A max.), or no connection, enables the converter. Control voltages should be referenced to pin 2 (-Input). Applying a voltage to the Control pin when no input power is applied to the converter can cause permanent damage to the converter.

### Synchronization

In certain applications employing multiple UHR converters and also demanding minimal noise levels, some improvements may be had by synchronizing the switching of the various converters. The synchronizing clock should be applied to pin 4 (Control) of each device. It should be a square wave with a maximum 1 $\mu$ sec "high" duration and an amplitude between +2V and +5V (see On/Off Control) referenced to pin 2 (-Input). The frequency of the synchronizing clock should be higher than that of any individual converter. Therefore, it should be 180kHz  $\pm$ 5kHz.

### Output Trimming

$V_{OUT}$  may be trimmed  $\pm$ 5% via a single external trimpot or fixed resistor. The trimpot should be connected as shown in Figure 2a with its wiper connected to pin 8 (Trim). A trimpot can be used to determine the value of a single fixed resistor which should be connected as shown in Figure 2b. Connect the resistor between pin 8 (Trim) and pin 6 (+Output) to trim "down" the output voltage. Connect the resistor between pins 8 and 7 (Common) to trim "up" the output voltage. Fixed resistors should be metal-film types with absolute TCR's less than 100ppm/ $^{\circ}$ C to ensure stability.

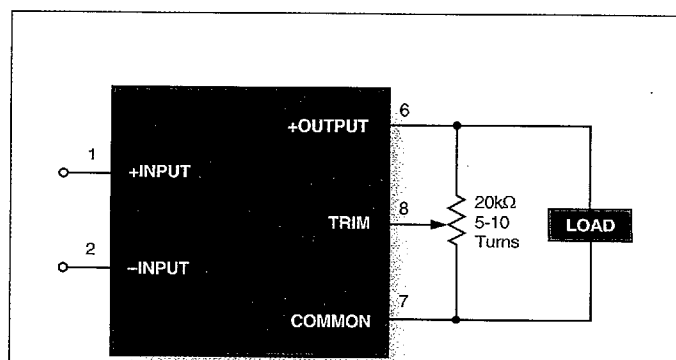


Figure 2a. Trim Connections Using a Trimpot

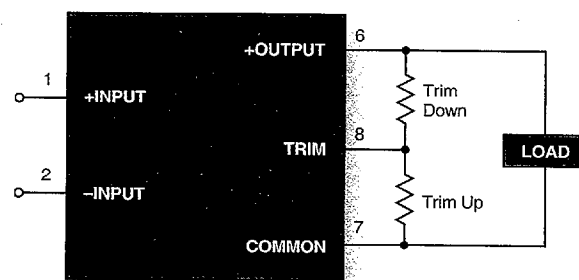


Figure 2b. Trim Connections Using Fixed Resistors