Single Output
UCP Models

UL/EN Approved, "Half-Brick" 50-60 Watt, DC/DC Converters

Features

- **Standard "half-brick" configuration**
- **UL1950 and EN60950 safety approvals (BASIC insulation)**
- **CE mark for "D48" models (36-75V inputs)**
- **Fully isolated, 1500Vdc guaranteed**
- **Output voltages: 3.3, 5, 12 or 15 Volts**
- **Input voltage ranges: 18-36V, 36-75V**
- **Full 50/60 Watt output power**
- **Reliable SMT-on-pcb construction**
- **Input under and overvoltage shutdown**
- **Output current limiting and short-circuit protection**
- **On/off, V$_{OUT}$ trim and sense functions**
- **Modifications and customs for OEM's**

The high efficiency, low noise and long-term reliability that defines DATEL DC/DC Converters now comes to you in the standard "half-brick" configuration (2.3" x 2.4" x 0.5"). All models in our new UCP Series meet UL1950 and EN60950 safety requirements, including each European country's deviations. A CB Test Certificate/ Report is available. All models have BASIC insulation; guarantee 1500Vdc isolation; and because they are designed with Class B thermal insulation, satisfy all safety requirements over their full operating temperatures.

UCP Models are designed for demanding telecom, datacom and networking applications. Their "semi-synchronous-rectifier" design (400kHz switching) achieves impressive efficiencies (up to 88%). Output voltages are 3.3, 5, 12 or 15 Volts. Input voltage ranges are 18-36V ("D24" models) or 36-75V ("D48" models). All "D48" models meet the Low Voltage Directive (LVD) and carry the CE mark.

For high reliability and affordability, DATEL utilizes high-speed automatic assembly to construct the UCP's proven SMT-on-pcb designs. All models have been rigorously qualified (including a 500-hour life test) and EMC characterized. Devices are housed in metal cases (with non-conductive baseplates) that incorporate threaded inserts for add-on heat sinks and/or pcb mounting.

UCP's feature input pi filters, input undervoltage and overvoltage lockout, output current limiting, short-circuit protection, and thermal shutdown. Additionally, all devices have output trim capability and an on/off control pin that can be ordered with either polarity or replaced with a sync function. We can easily modify standard-product UCP's to meet your application-specific requirements.
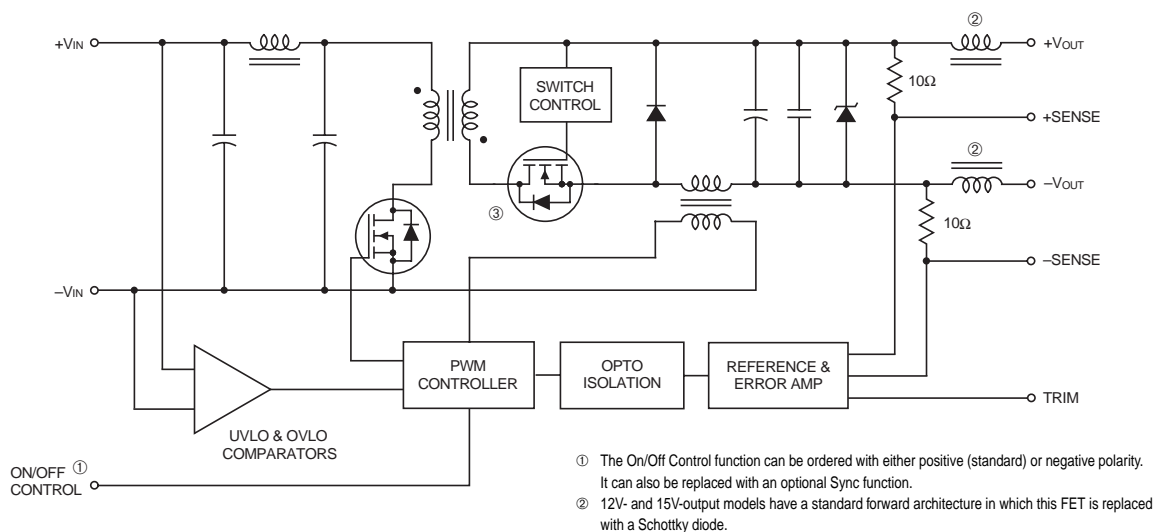

① The On/Off Control function can be ordered with either positive (standard) or negative polarity. It can also be replaced with an optional Sync function.

② 12V- and 15V-output models have a standard forward architecture in which this FET is replaced with a Schottky diode.

Figure 1. Simplified Schematic

Performance Specifications and Ordering Guide [1]

Model	Output						Input			Efficiency		Package (Case, Pinout)
	V_{OUT} (Volts)	I_{OUT} (Amps)	R/N (mVp-p) [2]		Regulation (Max.)		V_{IN} Nom. (Volts) [4]	Range (Volts) [4]	I_{IN} [5] (mA)	Min.	Typ.	
			Typ.	Max.	Line	Load [3]						
UCP-3.3/15-D24	3.3	15	75	150	±0.5%	±1.0%	24	18-36	75/2515	81%	83%	C12, P17
UCP-3.3/15-D48	3.3	15	75	150	±0.5%	±1.0%	48	36-75	75/1258	81%	83%	C12, P17
UCP-5/12-D24	5	12	75	120	±0.5%	±1.0%	24	18-36	75/2924	85%	87%	C12, P17
UCP-5/12-D48	5	12	75	120	±0.5%	±1.0%	48	36-75	75/1462	84%	86%	C12, P17
UCP-12/5-D24	12	5	75	120	±0.5%	±1.0%	24	18-36	50/2924	84%	86%	C12, P17
UCP-12/5-D48	12	5	75	120	±0.5%	±1.0%	48	36-75	50/1420	86%	88%	C12, P17
UCP-15/4-D24	15	4	100	150	±0.5%	±1.0%	24	18-36	50/2841	86%	88%	C12, P17
UCP-15/4-D48	15	4	100	150	±0.5%	±1.0%	48	36-75	50/1420	86%	88%	C12, P17

[1] Typical at T_A = +25°C under nominal line voltage and full-load conditions unless otherwise noted.

[2] Ripple/Noise (R/N) measured over a 20MHz bandwidth. All models are specified with external 33µF, low-ESR, input capacitors and 10µF tantalum in parallel with 1µF ceramic output capacitors.

[3] 10% to 100% load.

[4] Contact DATEL Applications Engineering for availability of other input voltage ranges such as 9-18V (12V nominal).

[5] Nominal line voltage, no-load/full-load conditions.

PART NUMBER STRUCTURE

U CP - 5 / 12 - D48 N

Output Configuration:
U = Unipolar

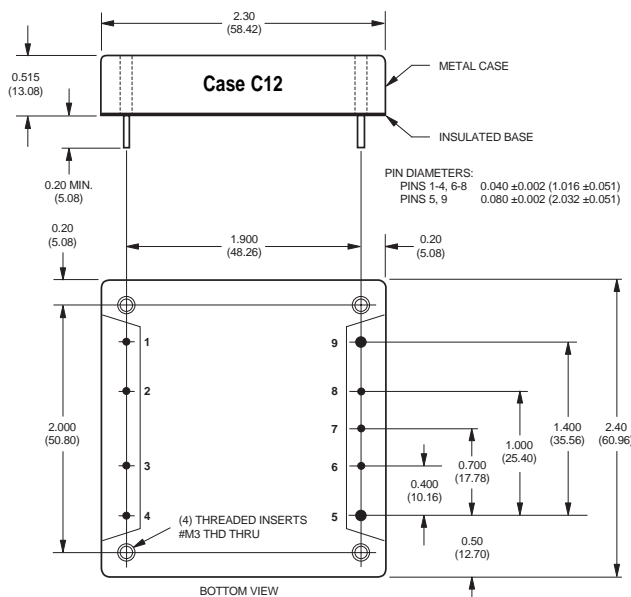**Standard Half-Brick Package**

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

Maximum Output Current
in Amps

Input Voltage Range:
D24 = 18-36 Volts (24V nominal)
D48 = 36-75 Volts (48V nominal)

Add "N" or "S" suffix as desired

Part Number Suffixes

Standard UCP Model DC/DC Converters are supplied with a positive polarity on their on/off control function (pin 3 open = on). To order devices with a negative polarity on pin 3 (open = off), add an "N" suffix to the part number. To replace the on/off function with a sync function, add an "S" suffix. See Technical Notes for more details.
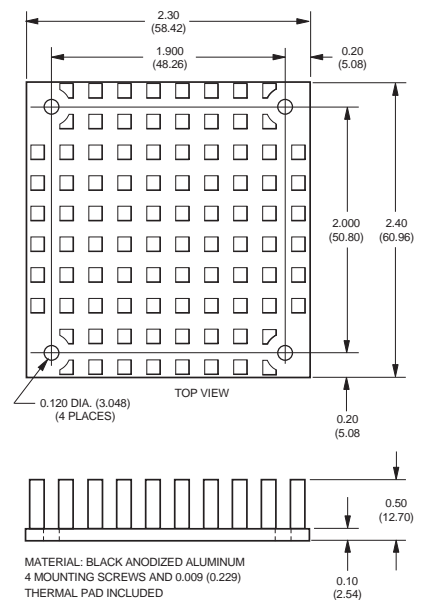
MECHANICAL SPECIFICATIONS

2.30 (58.42)

0.515 (13.08)

Case C12

METAL CASE

INSULATED BASE

0.20 MIN. (5.08)

0.20 (5.08)

1.900 (48.26)

0.20 (5.08)

PIN DIAMETERS:
PINS 1-4, 6-8   0.040 ±0.002 (1.016 ±0.051)
PINS 5, 9   0.080 ±0.002 (2.032 ±0.051)

2.000 (50.80)

1.400 (35.56)   2.40 (60.96)

1.000 (25.40)

0.700 (17.78)

0.400 (10.16)

0.50 (12.70)

(4) THREADED INSERTS
#M3 THD THRU

BOTTOM VIEW

I/O Connections	
Pin	Function P17
1	–Input
2	Case
3	On/Off Control
4	+Input
5	+Output
6	+Sense
7	Trim
8	–Sense
9	–Output

Optional Heat Sink (Part Number HS-CP)

2.30 (58.42)

1.900 (48.26)

0.20 (5.08)

2.000 (50.80)   2.40 (60.96)

0.120 DIA. (3.048)
(4 PLACES)

TOP VIEW

0.20 (5.08)

0.50 (12.70)

MATERIAL: BLACK ANODIZED ALUMINUM
4 MOUNTING SCREWS AND 0.009 (0.229)
THERMAL PAD INCLUDED

0.10 (2.54)

Performance/Functional Specifications

Typical @ T$_A$ = +25°C under nominal line voltage and full-load conditions, unless noted. ① ②

Input	
Input Voltage Range: ③	
"D24" Models	18-36 Volts (24V nominal)
"D48" Models	36-75 Volts (48V nominal)
Overvoltage Shutdown:	
"D24" Models	40 Volts
"D48" Models	80 Volts
Start-Up Threshold: ④	
"D24" Models	17 Volts
"D48" Models	35 Volts
Undervoltage Shutdown: ④	
"D24" Models	16 Volts
"D48" Models	34 Volts
Input Current:	
Normal Operating Conditions	See Ordering Guide
Standby Mode (Off, OV, UV)	5mA
Input Filter Type	Pi
Reverse-Polarity Protection:	
"D24" Models	Brief duration, 15A maximum
"D48" Models	Brief duration, 10A maximum
On/Off Control (Pin 3) ⑤	TTL high (or open) = on, low = off
Output	
V$_{OUT}$ Accuracy (50% load): ⑥	
3.3V Outputs	±1.5%, maximum
5/12/15V Outputs	±1%, maximum
Temperature Coefficient	±0.04% per °C
Ripple/Noise (20MHz BW) ② ⑦	See Ordering Guide
Line/Load Regulation	See Ordering Guide
Efficiency	See Ordering Guide
Isolation Voltage:	
Input-to-Output	1500Vdc, minimum
Input-to-Case	1500Vdc, minimum
Output-to-Case	1500Vdc, minimum
Isolation Capacitance	750pF
Isolation Resistance	100MΩ
Current Limiting:	
3.3V and 5V Outputs	Hiccup technique, auto-recovery
12V and 15V Outputs	Power-limiting technique, auto-recovery
Overvoltage Protection	Zener/transorb clamp, magnetic feedback
Dynamic Characteristics	
Transient Response (50% load step)	200µsec max. to ±1.5% of final value
Start-Up Time: ④	
V$_{IN}$ to V$_{OUT}$	50msec
On/Off to V$_{OUT}$	30msec
Switching Frequency	400kHz (±25kHz)
Environmental	
Operating Temperature (Ambient):	
Without Derating	–40 to +45/50°C (Model dependent)
With Derating	to +100°C (See Derating Curves)
Case Temperature:	
Maximum Allowable	+100°C
For Thermal Shutdown	+95°C minimum, +105°C maximum
Storage Temperature	–40 to +105°C

Physical	
Dimensions	2.3 x 2.4 x 0.515" (58.4 x 61 x 13.1mm)
Shielding	5-sided
Case Connection	Pin 2
Case Material	Zinc with a non-conductive, epoxy-based black enamel finish and plastic baseplate
Pin Material	Brass, solder coated
Weight	5.3 ounces (149 grams)

① These power converters require a minimum 10% output loading to maintain specified regulation. Operation under no-load conditions will not damage these devices; however they may not meet all listed specifications.

② All models are specified with external 33µF, low-ESR, input capacitors and 10µF tantalum in parallel with 1µF ceramic output capacitors.

③ Contact DATEL Applications Engineering for availability of other input voltage ranges such as 9-18V (12V nominal).

④ See Technical Notes for details.

⑤ Devices may be ordered with the opposite polarity (pin 3 open = off), or the on/off control function can be replaced with a sync function. See Part Number Suffixes and Technical Notes for additional information.

⑥ Accracy is specified with the sense pins tied directly to their respective output pins.

⑦ Output noise may be further reduced with the installation of additional external output capacitors. See Technical Notes.

Absolute Maximum Ratings	
Input Voltage:	
Continuous:	
"D24" Models	44 Volts
"D48" Models	88 Volts
Transient (100msec):	
"D24" Models	50 Volts
"D48" Models	100 Volts
Input Reverse-Polarity Protection	
"D24/D48" Models	Current must be <15/10 Amps. Brief duration only. Fusing recommended.
Output Overvoltage Protection	
3.3V Outputs	4.5 Volts, limited duration
5V Outputs	6.8 Volts, limited duration
12V Outputs	15 Volts, limited duration
15V Outputs	18 Volts, limited duration
Output Current	Current limited. 12/15V devices can withstand an output short circuit for a brief duration only. 3.3/5V devices can withstand output shorts indefinitely.
Storage Temperature	–40 to +105°C
Lead Temperature (soldering, 10 sec.)	+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.
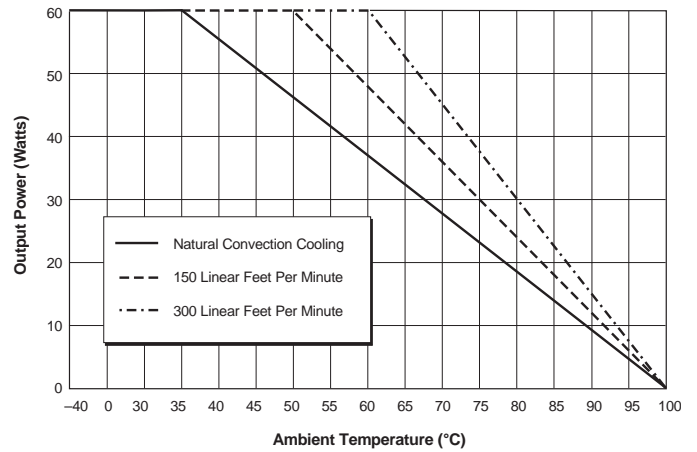
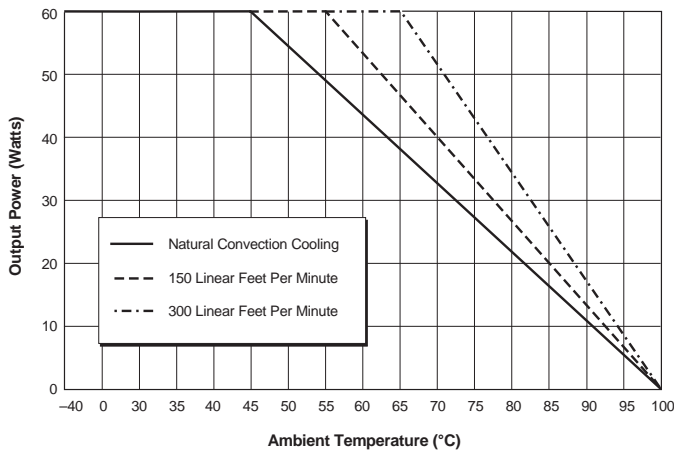## Temperature Derating and Electrical Performance Curves

D24 Models (60 Watts)
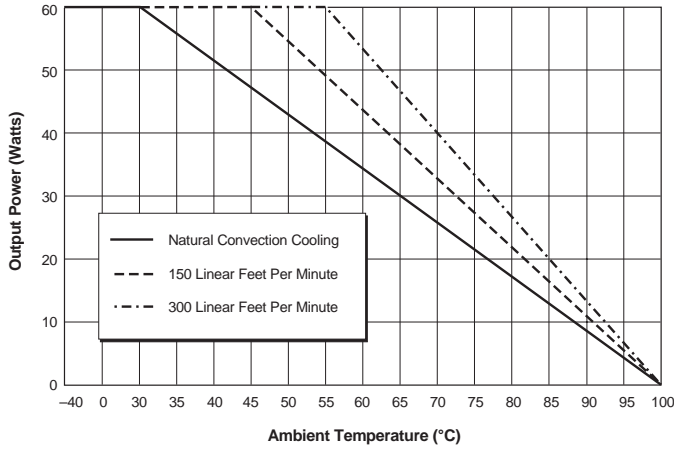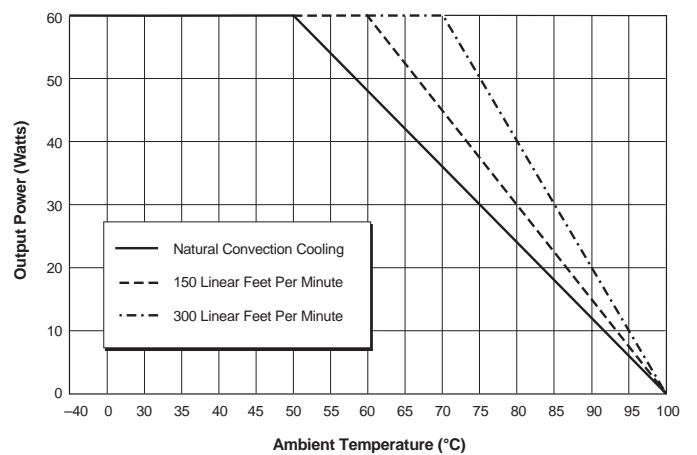

Figure 2a. Temperature Derating Without Heat Sink

D48 Models (60 Watts)

Figure 3a. Temperature Derating Without Heat Sink

Figure 2b. Temperature Derating With HS-CP Heat Sink

Figure 3b. Temperature Derating With HS-CP Heat Sink

Floating Outputs

Since these are isolated DC/DC converters, their outputs are "floating." Designers will usually use the –Output (pin 9) as the ground/return of the load circuit. You can, however, use the +Output (pin 5) as ground/return to effectively reverse the output polarity.

Filtering and Noise Reduction

All UCP DC/DC Converters achieve their rated ripple and noise specifications using the external input and output capacitors specified in the Performance/ Functional Specifications table. In critical applications, input/output noise may be further reduced by installing additional external I/O caps. Input capacitors should be selected for bulk capacitance, low ESR and high rms-ripple-current ratings. Output capacitors should be selected for low ESR and appropriate frequency response. All caps should have appropriate voltage ratings and be mounted as close to the converters as possible.

The most effective combination of external I/O capacitors will be a function of your particular load and layout conditions. Our Applications Engineers will be happy to recommend potential solutions and can discuss the possibility of our modifying a given device's internal filtering 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. Fuses should also be used if the possibility of sustained, non-current-limited, input-voltage polarity reversals exists. For DATEL UCP DC/DC Converters, you should use slow-blow type fuses with values no greater than the following.

V_{IN} Range	Fuse Value
"D24" Models	6 Amps
"D48" Models	3 Amps

Start-Up Threshold and Undervoltage Shutdown

Under normal start-up conditions, devices will not begin to regulate until the ramping-up input voltage exceeds the Start-Up Threshold Voltage (35V for "D48" models). Once operating, devices will not turn off until the input voltage drops below the Undervoltage Shutdown/Lockout limit (34V for "D48" models). Subsequent re-start will not occur until the input is brought back up to the Start-Up Threshold. This built-in hysteresis obviously avoids any unstable on/off situations at a single voltage.

Start-Up Time

The V_{IN} to V_{OUT} start-up time is the interval between the time at which a ramping input voltage crosses the turn-on threshold point and the fully-loaded output voltage enters and remains within its specified accuracy band. Actual measured times will vary with input source impedance, external input capacitance, and the slew rate and final value of the input voltage as it appears to the converter.

The On/Off to V_{OUT} start-up time assumes the converter has its nominal input voltage applied but is turned off via the On/Off Control. The specification defines the interval between the time at which the converter is turned on and the fully loaded output voltage enters and remains within its specified accuracy band.

On/Off Control (Standard)

The On/Off Control pin (pin 3) may be used for remote on/off operation. As shown in Figure 4, the control pin is referenced to the –Input (pin 1) and has an internal pull-up resistor (75kΩ and 100kΩ respectively for "D24" and "D48" models) to the +Input (pin 4). The standard UCP converter is designed so that it is enabled when the control pin is left open and disabled when the control pin is pulled low (to less than +0.8V relative to –Input). When left open, pin 3 is pulled up to approximately 5V on "D24" models and 8V on "D48" models.

Dynamic control of the on/off function is best accomplished with a mechanical relay or an open-collector/open-drain drive circuit (optically isolated if appropriate). The drive circuit should obviously be able to sink approximately 1mA when activated and withstand more than 10 Volts when deactivated.

Applying an external voltage to pin 3 when no input power is applied to the converter can cause permanent damage to the converter. The on/off control function, however, is designed such that the converter can be disabled (pin 3 pulled low) while input power is ramping up and then "released" once the input has stabilized. Under these circumstances, it takes approximately 30ms for the output of the fully loaded DC/DC to ramp up and settle to within rated accuracy.

For UCP converters configured with the negative-polarity option on the On/ Off Control pin ("N" suffix added to part number), operation is exactly opposite to that described above.

Synchronization (Optional)

In critical applications employing multiple switching DC/DC converters, it may be desirable to intentionally synchronize the switching of selected converters (so the system noise can be reduced with notch filtering) or to purposely desynchronize the converters (to lessen the current-carrying requirements on intermediate dc buses). UCP DC/DC Converters have been designed so that the On/Off Control function on pin 3 can be replaced with a Sync function (add "S" suffix to part number). This change has to be implemented by DATEL during the product assembly process. Contact our Applications Engineering Group for additional details.

To synchronize the switching of multiple UCP converters configured with the Sync function, an external clock can be applied to pin 3 of each converter. The clock should be a square wave referenced to –Input (logic high = +3.5 to +5 Volts, 800µA max.; logic low = 0 to +1 Volt, 800µA max.) with a maximum 1µsec "high" duration. The frequency of the synchronizing clock should be higher than that of any individual converter. Therefore, it should be approximately 430kHz.

Output Trimming

V_{OUT} may be trimmed ±5% via a single trimpot or fixed resistor. As shown in Figure 5, the trimpot should be connected between +Output (pin 5) and –Output (pin 9) with its wiper connected to Trim (pin 7). A trimpot can also be used to determine the value of a single fixed resistor which can be connected between pin 7 (Trim) and pin 5 (+Output) to trim "down" the output voltage, or between pins 7 (Trim) and 9 (–Output) to trim "up" the output voltage, as shown in Figure 6. Fixed resistors should be metal-film types with absolute TCR's less than 100ppm/°C to ensure stability.

The Sense Pins

Switching DC/DC converters incorporate a feedback loop that continuously monitors the difference between the output voltage and an internal precision reference. In situations in which load currents and/or conductor impedances are relatively high, there may be unacceptable voltage drops between the converter output and its load. The purpose of the Sense pins (pins 6 and 8) is to monitor and feed back the output voltage at the load, rather than at the output of the converter, and to adjust the converter output as necessary to maintain the load voltage at its desired level.

The Sense pins (which the converter output sees as having an effective 10 Ohm line impedance) should be connected across the output voltage at the load and not at the output of the converter. See Figure 7. The Sense pins then function similar to the Trim pin, and they effectively have the same ±5% compensation range. If, for example, the combination of load current and line impedance causes a 5V output to drop to +4.75V at its load (a 5% drop), the sense function will compensate by raising the output voltage at the converter to +5.25V. If the load voltage drops to +4.5V, the sense function will not be able to compensate for the full drop, and other measures (like reducing line impedance) must be taken.

If you are using both the external Trim and Sense functions, you must not attempt to force the converter output voltage more than 5% above its initial, "untrimmed" value.

When UCP DC/DC Converters are tested for output accuracy during final test, the Sense pins are connected directly to their respective output pins.
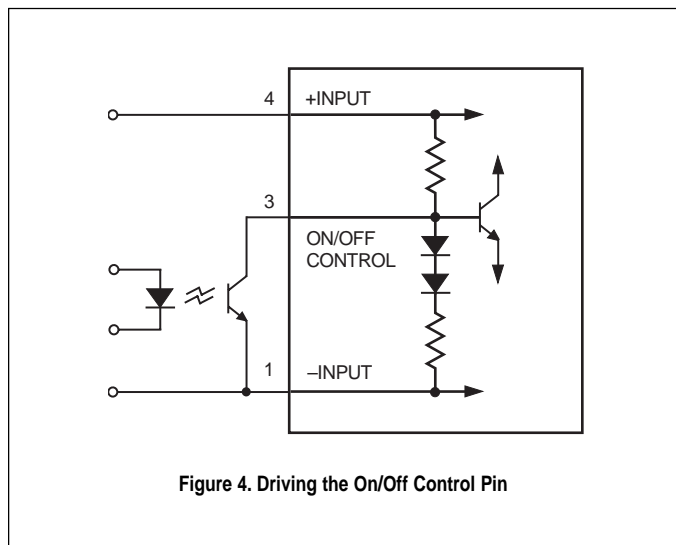
Figure 4. Driving the On/Off Control Pin
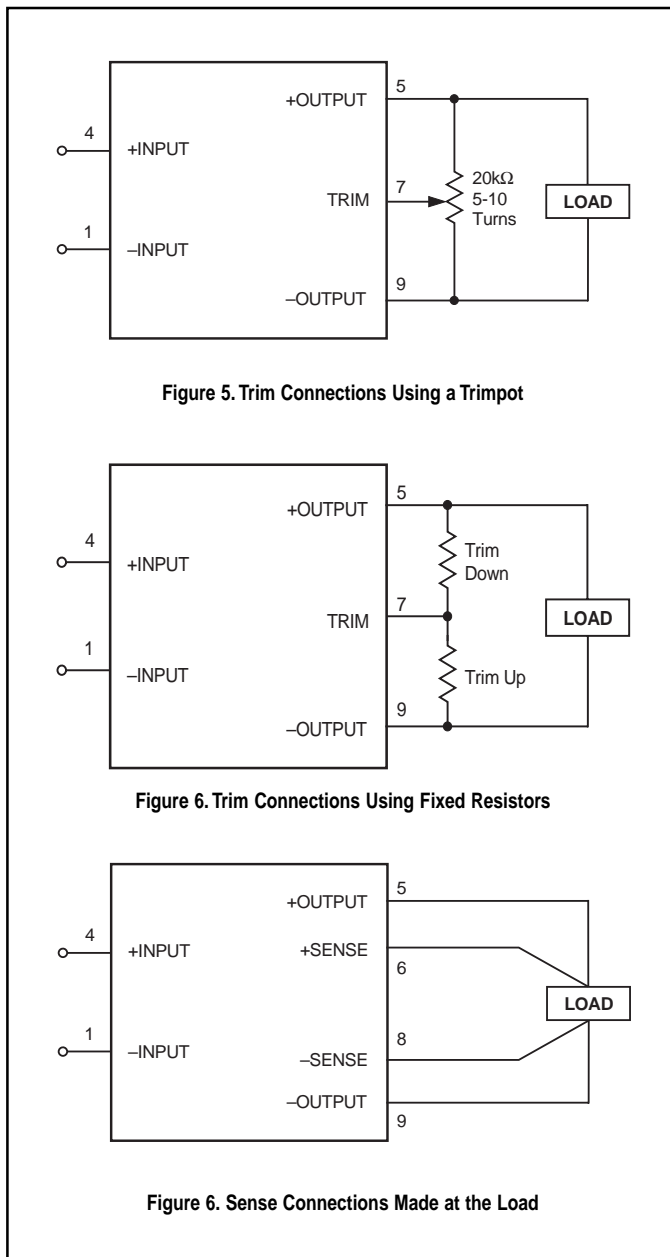
Figure 5. Trim Connections Using a Trimpot

Figure 6. Trim Connections Using Fixed Resistors

Figure 6. Sense Connections Made at the Load

Case Connection

Unlike most other DC/DC converters, UCP DC/DC's do not have their metal case connected to one of their input pins. The "uncommitted" case is connected to pin 2 which, depending upon your system configuration, should be connected to either +Input (pin 4), –Input (pin 1), –Output (pin 9), or earth ground.