DATEL
®

INNOVATION and EXCELLENCE

Single Output
UCP Models

UL/EN Approved, "Half-Brick"
40-75 Watt, DC/DC Converters

Features

- **Standard "half-brick" configuration**
- **UL/EN60950 safety approvals (BASIC insulation)**
- **ϵ mark for "D48" models (36-75V inputs)**
- **Fully isolated, 1500Vdc guaranteed**
- **Output voltages: 3.3, 5, 12 or 15 Volts**
- **V_{IN} ranges: 10-18V, 18-36V, 36-75V**
- **Full 40-75 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 0.52"). All models in our new UCP Series meet UL/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 10-18V ("D12" models), 18-36V ("D24" models) or 36-75V ("D48" models). "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.
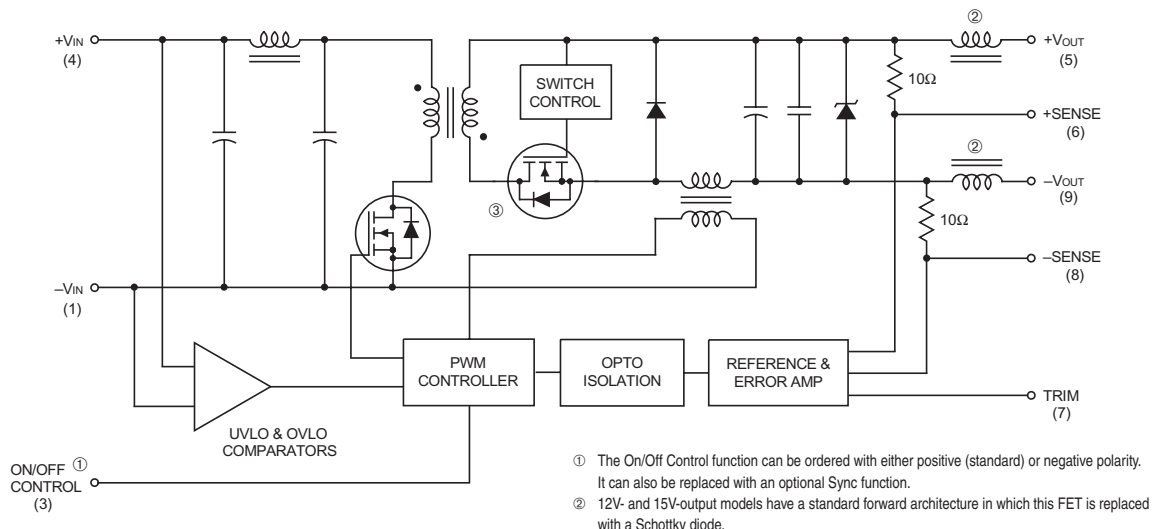

① The On/Off Control function can be ordered with either positive (standard) or negative polarity. It can also be replaced with an optional Sync function.
② 12V- and 15V-output models have a standard forward architecture in which this FET is replaced with a Schottky diode.

Figure 1. Simplified Schematic

Performance Specifications and Ordering Guide ①

Model	Output							Input			Efficiency		Package (Case, Pinout)
	V_{OUT} (Volts)	I_{OUT} (Amps)	P_{OUT} (W)	R/N (mVp-p) ②		Regulation (Max.)		V_{IN} Nom. (Volts)	Range (Volts)	I_{IN} ④ (mA/A)	Min.	Typ.	
				Typ.	Max.	Line	Load ③						
UCP-3.3/12-D12	3.3	12	40	75	150	±0.5%	±1.0%	12	10-18	200/4.2	81%	83%	C12, P17
UCP-3.3/15-D24	3.3	15	50	75	150	±0.5%	±1.0%	24	18-36	75/2.6	81%	83%	C12, P17
UCP-3.3/15-D48	3.3	15	50	75	150	±0.5%	±1.0%	48	36-75	75/1.3	81%	83%	C12, P17
UCP-5/10-D12	5	10	50	75	120	±0.5%	±1.0%	12	10-18	200/5.2	82%	84%	C12, P17
UCP-5/12-D24	5	12	60	75	120	±0.5%	±1.0%	24	18-36	75/3	85%	87%	C12, P17
UCP-5/12-D48	5	12	60	75	120	±0.5%	±1.0%	48	36-75	75/1.5	84%	86%	C12, P17
UCP-5/15-D48	5	15	75	75	120	±0.5%	±1.0%	48	36-75	100/1.9	84.5%	86%	C12, P17
UCP-12/4.2-D12	12	4.2	50	75	120	±0.5%	±1.0%	12	10-18	100/5	85%	87%	C12, P17
UCP-12/5-D24	12	5	60	75	120	±0.5%	±1.0%	24	18-36	50/3	84%	86%	C12, P17
UCP-12/5-D48	12	5	60	75	120	±0.5%	±1.0%	48	36-75	50/1.5	86%	88%	C12, P17
UCP-15/3.3-D12	15	3.3	50	100	150	±0.5%	±1.0%	12	10-18	100/4.9	85%	87%	C12, P17
UCP-15/4-D24	15	4	60	100	150	±0.5%	±1.0%	24	18-36	50/2.9	86%	88%	C12, P17
UCP-15/4-D48	15	4	60	100	150	±0.5%	±1.0%	48	36-75	50/1.5	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 step.

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

PART NUMBER STRUCTURE

U CP - 5 / 12 - D48 N LX

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:
D12 = 10-18 Volts (12V nominal)
D24 = 18-36 Volts (24V nominal)
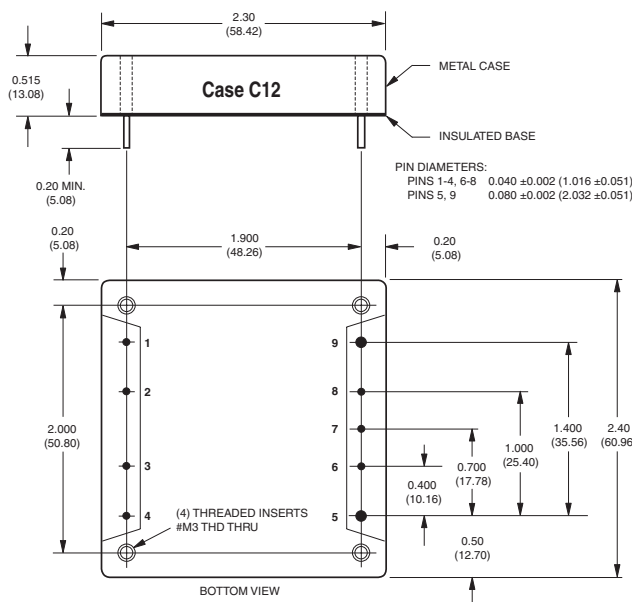**D48** = 36-75 Volts (48V nominal)

See Optional Functions

Optional Functions

UCP 40-75 Watt DC/DC's are designed with an On/Off Control function, with either positive polarity (no suffix) or negative polarity ("N" suffix), in the pin 3 position.

Blank	On/Off Control function (positive polarity) on pin 3
N	On/Off Control function (negative polarity) on pin 3
L1	Pin length: 0.110 inches (2.79mm) ±0.010
L2	Pin length: 0.145 inches (3.68mm) ±0.010

MECHANICAL SPECIFICATIONS

2.30 (58.42)

0.515 (13.08)

Case C12

METAL CASE

INSULATED BASE

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)

0.20 MIN. (5.08)

0.20 (5.08)

1.900 (48.26)

0.20 (5.08)

2.000 (50.80)

1.400 (35.56)   2.40 (60.96)

1.000 (25.40)

0.700 (17.78)

0.400 (10.16)

(4) THREADED INSERTS #M3 THD THRU

0.50 (12.70)

BOTTOM VIEW

I/O Connections

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

Optional Heat Sinks

DATEL offers two heat sinks (part number HS-CP and HS-CPLP2) for the UCP models. For mechanical specifications, see page 7.

Performance/Functional Specifications

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

Input	
Input Voltage Range:	
D12 Models	12-18 Volts (12V nominal)
D24 Models	18-36 Volts (24V nominal)
D48 Models	36-75 Volts (48V nominal)
Overvoltage Shutdown:	
D12 Models	20 Volts
D24 Models	40 Volts
D48 Models	80 Volts
Start-Up Threshold: ③	
D12 Models	9.5 Volts
D24 Models	17 Volts
D48 Models	35 Volts
Undervoltage Shutdown: ③	
D12 Models	9 Volts
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:	
D12/D24 Models	Brief duration, 15A maximum
D48 Models	Brief duration, 10A maximum
On/Off Control (Pin 3) ④	TTL high (or open) = on, low = off

Output	
VOUT **Accuracy** (50% load): ⑤	
3.3V Outputs	±1.5%, maximum
5/12/15V Outputs	±1%, maximum
Temperature Coefficient	±0.04% per °C
Ripple/Noise (20MHz BW) ①⑥	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: ③	
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 See Technical Notes for details.

④ 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.

⑤ Accracy is specified with the sense pins tied directly to their respective output pins.

⑥ Output noise may be further reduced with the installation of additional external output capacitors. See Technical Notes.

Absolute Maximum Ratings	
Input Voltage:	
Continuous:	
D12 Models	22 Volts
D24 Models	44 Volts
D48 Models	88 Volts
Transient (100msec):	
D12 Models	25 Volts
D24 Models	50 Volts
D48 Models	100 Volts
Input Reverse-Polarity Protection	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.
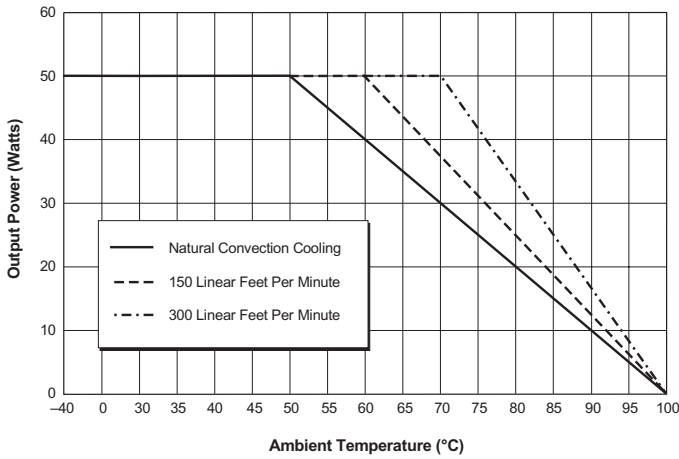
D12 Models (50 Watts)

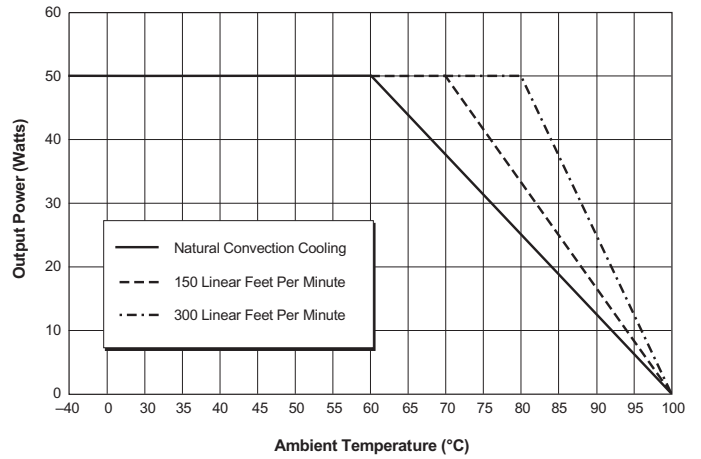Figure 2a. Temperature Derating Without Heat Sink

Figure 2b. Temperature Derating With HS-CP Heat Sink
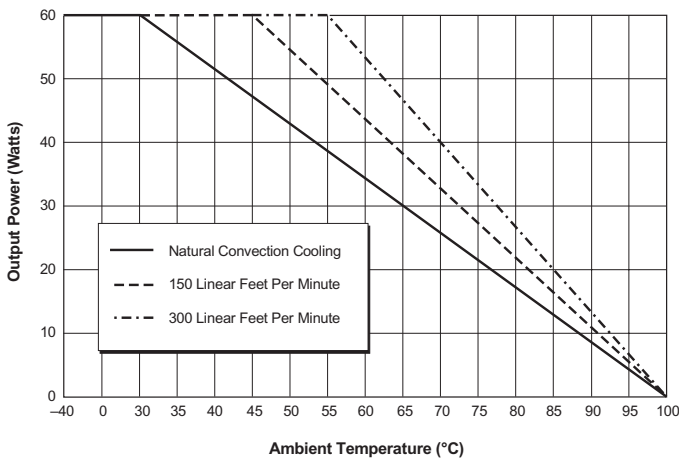
D24 Models (60 Watts)

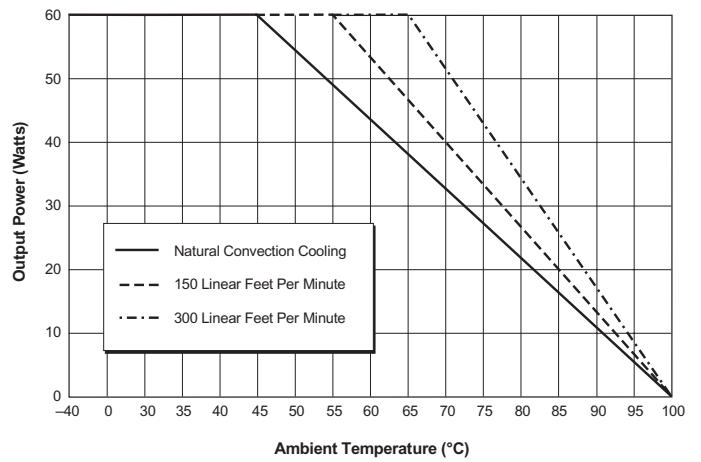Figure 3a. Temperature Derating Without HS-CP Heat Sink

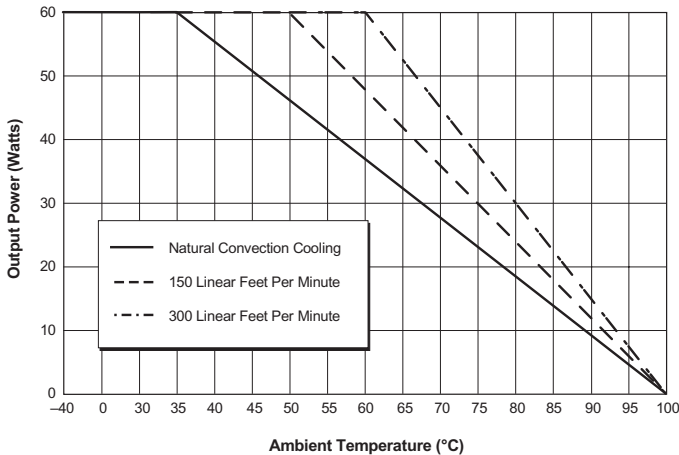Figure 3b. Temperature Derating With HS-CP Heat Sink

D48 Models (60 Watts)
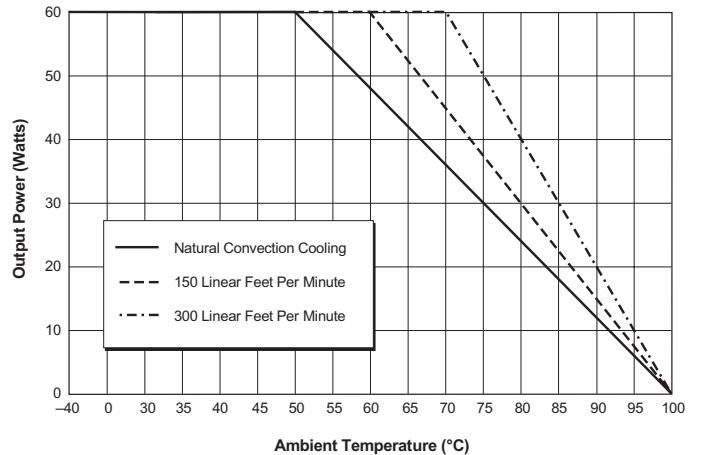

Figure 4a. Temperature Derating Without HS-CP Heat Sink

Figure 4b. 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
D12 Models	7 Amps
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 5, the control pin is referenced to the –Input (pin 1) and has an internal pull-up resistor (28.7kΩ, 75kΩ and 100kΩ respectively for D12, 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.
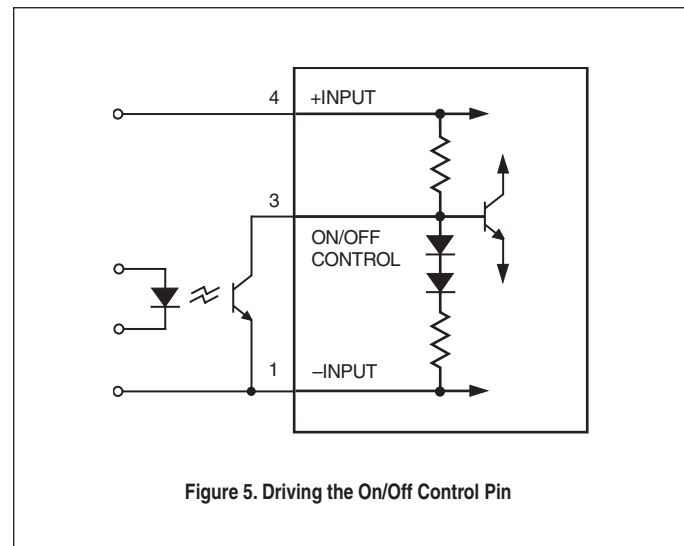

Figure 5. Driving the On/Off Control Pin

Input Reverse-Polarity Protection

Upon applying a reverse-polarity voltage to the DC/DC converter, an internal diode will be forward biased and draw excessive current from the power source. Therefore, it is required that the input current be limited be either an appropriately rated input fuse or a current limited power source.

Output Trimming

V$_{OUT}$ may be trimmed ±5% via a single trimpot or fixed resistor. As shown in Figure 6, 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 7. 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 8. 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.

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.
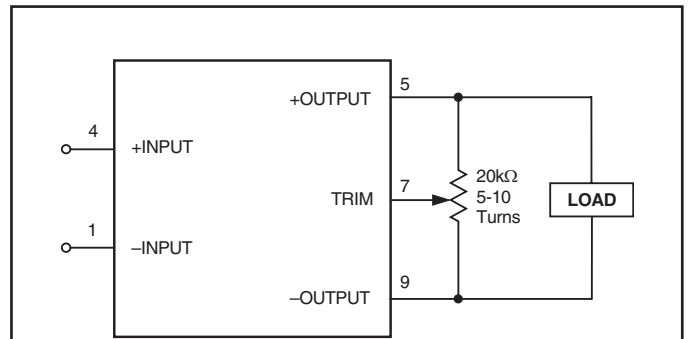

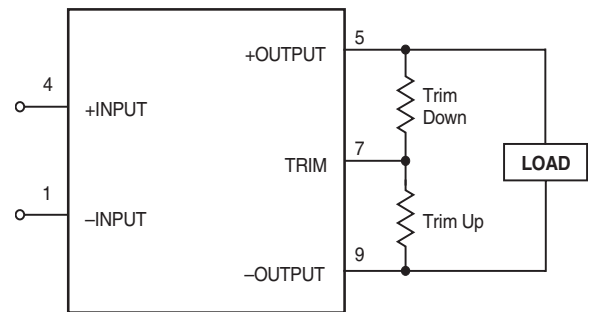**Figure 6. Trim Connections Using a Trimpot**

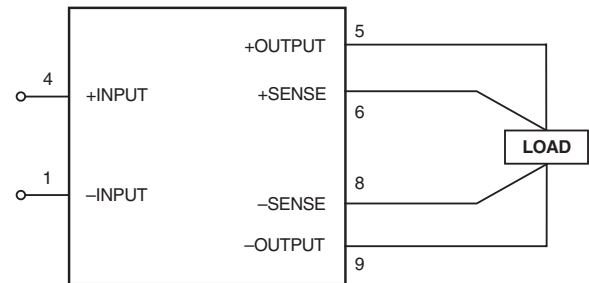**Figure 7. Trim Connections Using Fixed Resistors**

Figure 8. Sense Connections Made at the Load

6

Heat Sinks for UCP Series

DATEL offers two standard heat sinks that can be mounted to the half-brick package to extend the converter's operating temperature range. Along with the standard 2.3" x 2.4" x 0.5" (HS-CP) heat sink, DATEL has designed a low-profile heat sink for height-restricted applications. This new heat sink (HS-CPLP2) is designed with radiant fins that extend 0.51" beyond either side of the 2.4" dimension of the BCP package. The convenience of this design is that the finned extensions protrude only 0.31" below the top surface of the DC/DC converter, allowing components with a profile height less than 0.2" to be mounted on the pc board below the heat sink. Therefore, while the surface area of the low-profile heat sink measures 2.3" x 3.5", pcb real estate is unaffected.

For optimum thermal performance in a natural convection application, the low-profile heat sink should be mounted with the fins vertically oriented. Both models are shipped with 0.009" sellf-adhesive thermal pad and mounting screws.

Note: When mounting the heat sink to the UCP converter:

1. Maximum applied torque is 6 in-lbs.

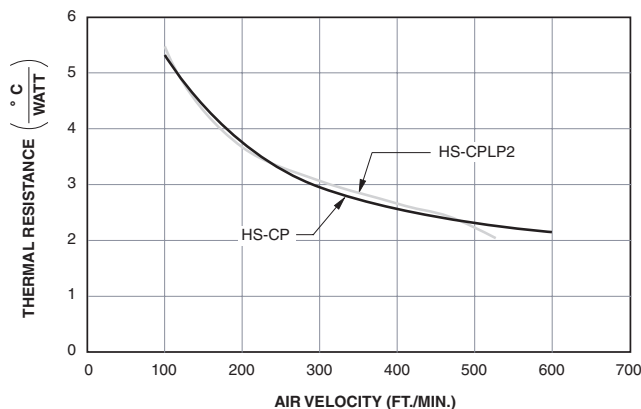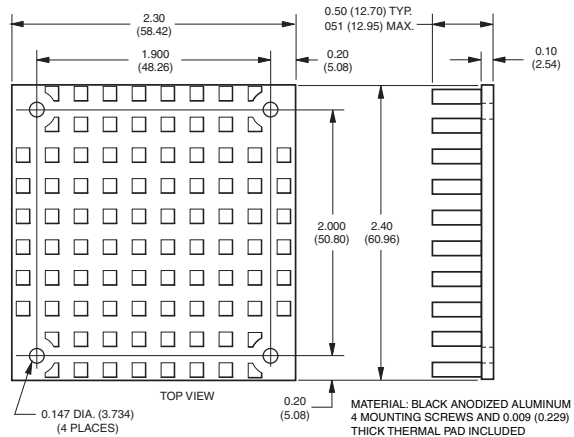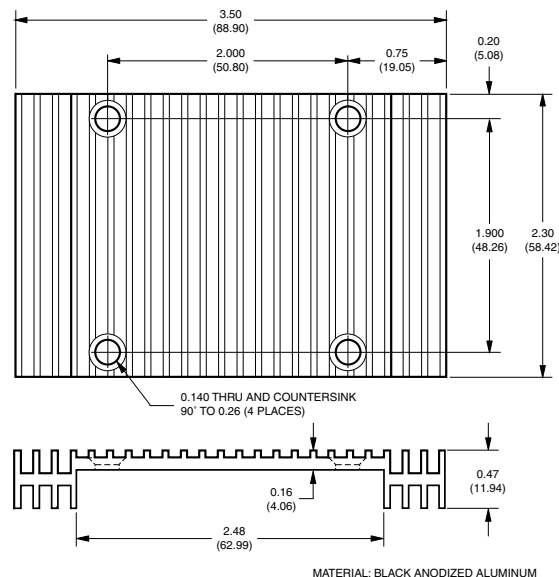2. Minimum thread engagement of the mounting screws is 12mm deep.

Optional Heat Sinks (Part Number HS-CP)

TOP VIEW

0.147 DIA. (3.734) (4 PLACES)

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

Optional Heat Sink (Part Number HS-CPLP2)

0.140 THRU AND COUNTERSINK 90° TO 0.26 (4 PLACES)

MATERIAL: BLACK ANODIZED ALUMINUM

Figure 9. HS-CP and HS-CPLP2 Heat Sink Performance Vs. Air Flow