Murata Power Solutions

# Single Output UCH Models

## Isolated, "Half-Brick" 2.5 –15V Output DC/DC Converters

## FEATURES

- Standard "half-brick" configuration
- Designed to meet UL/EN60950-1 safety approvals (BASIC insulation)
- Fully isolated, 2250Vdc guaranteed
- Output voltages: 1.8 – 15 Volts
- $V_{IN}$ range: 36-75V or 18-36V
- Full 50-150 Watt output power
- Reliable SMT-on-pcb construction
- Input under and output overvoltage shutdown
- Output current limiting and short-circuit protection
- On/off, $V_{OUT}$ trim and sense functions
- Modifications and customs for OEMs
- Lead-free RoHS construction/attach

Typical Unit

## PRODUCT OVERVIEW

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 0.39″). All models in our new UCH Series meet UL/EN60950-1 safety requirements, including each European country's deviations. All models have BASIC insulation; guarantee 2250Vdc (in to out) isolation; and because they are designed with Class B thermal insulation, satisfy all safety requirements over their full operating temperatures. Double lead-free construction/attach meets stringent RoHS specifications.

UCH Models are designed for demanding telecom, datacom and networking applications. Their "semi-synchronous-rectifier" design achieves impressive efficiencies. Output voltages are 1.8 to 15 Volts. The input voltage range is 36 to 75 or 18 to 36 Volts. All models meet the Low Voltage Directive (LVD).

For high reliability and affordability, DATEL utilizes high-speed automatic assembly to construct the UCH's proven SMT-on-pcb designs. All models have been rigorously qualified (including a 500-hour life test) and EMC characterized. An optional baseplate offers full output power at maximum temperature.

UCH's feature input 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.

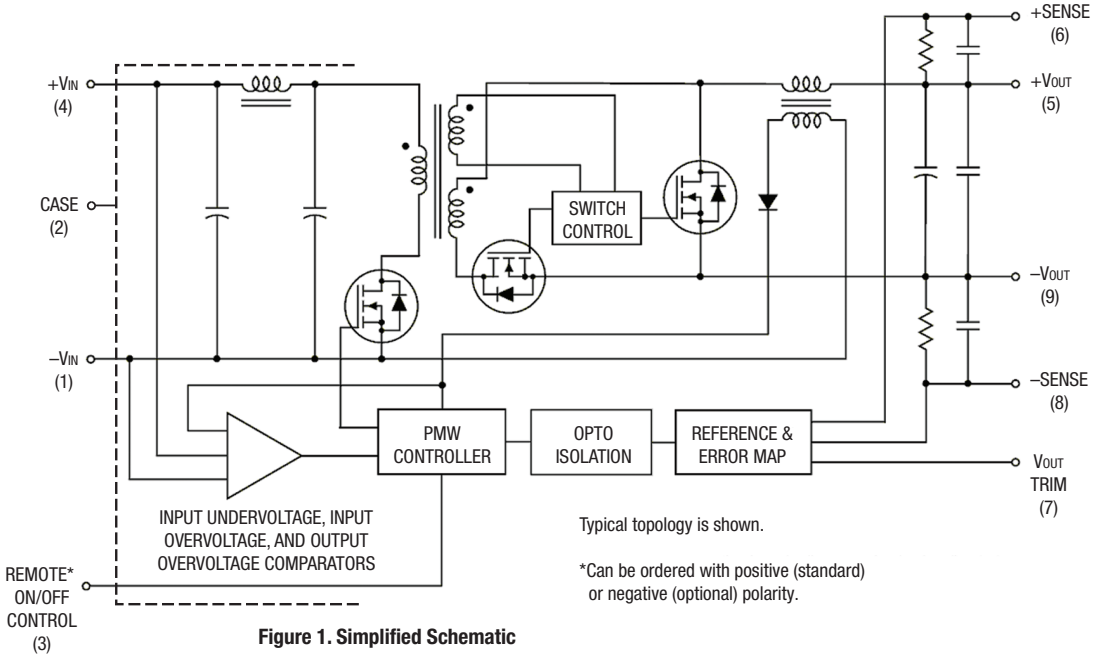


**Figure 1. Simplified Schematic**

RoHS COMPLIANT 2002/95/EC

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For full details go to **www.murata-ps.com/rohs**

## Performance Specifications and Ordering Guide ①

### ORDERING GUIDE

| Root Family ① | Output | | | | | | | Input | | | | Efficiency | | Package C61 Case | Pinout |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | R/N (mVp-p) ② | | Regulation (Max.) ③ | | | | | | | | | |
| | $V_{OUT}$ (Volts) | $I_{OUT}$ (Amps) | Power (Watts) | Typ. | Max. | Line | Load | $V_{IN}$ Nom. (Volts) | Range (Volts) | $I_{IN}$, no load (mA) | $I_{IN}$, full load (Amps) | Min. | Typ. | inches (mm) | |
| UCH-1.8/40-D48N-C | 1.8 | 40 | 72 | 50 | 100 | ±0.125% | ±0.25% | 48 | 36-75 | 50 | 1.72 | 85% | 87% | 2.4×2.28×0.39 (61×57.9×9.9) | P17 |
| UCH-2.5/40-D48N-C | 2.5 | 40 | 100 | | | ±0.1% | ±0.2% | 48 | 36-75 | | 2.34 | 87.5% | 89% | | |
| UCH-3.3/10-D24P-C | 3.3 | 10 | 33 | | 80 | ±0.2% | ±0.25% | 24 | 18-36 | 100 | 1.54 | 87% | | | |
| UCH-3.3/10-D48N-C | | 10 | 33 | | | ±0.2% | | 48 | 36-75 | | 0.77 | | | | |
| UCH-3.3/15-D48N-C | | 15 | 49.5 | | | ±0.2% | | 48 | 36-75 | | 1.16 | | | | |
| UCH-3.3/35-D24P-C | | 35 | 115.5 | | | ±0.125% | | 24 | 18-36 | | 5.41 | | | | |
| UCH-3.3/30-D48N-C | | 30 | 99 | | | ±0.2% | | 48 | 36-75 | | 2.29 | | 90% | | |
| UCH-5/10-D48N-C | 5 | 10 | 50 | 60 | 150 | ±0.125% | | 48 | 36-75 | | 1.17 | 85.5% | 89% | | |
| UCH-5/20-D24P-C | | 20 | 100 | 50 | 100 | ±0.125% | | 24 | 18-36 | | 4.6 | 89% | 90.5% | | |
| UCH-5/30-D48N-C | | 30 | 150 | 60 | | ±0.2% | | 48 | 36-75 | | 3.43 | | 91% | | |
| UCH-12/4.2-D48N-C | 12 | 4.2 | 50.4 | 80 | 150 | ±0.125% | | | | 90 | 1.16 | | 90.5% | | |
| UCH-12/12.5-D48N-C | 12 | 12.5 | 150 | 50 | 150 | ±0.125% | | | | | 3.37 | | 92.6% | | |
| UCH-15/6.7-D48N-C | 15 | 6.7 | 100.5 | 70 | | | | | | | 2.28 | 91% | 92% | | |

① Please refer to the full model number structure for additional ordering part numbers and options.
② All specifications are at nominal line voltage and full load, +25 °C. unless otherwise noted. See detailed specifications. Output capacitors are 1 µF ceramic || 10 µF electrolytic . Input cap is 22 µF, low ESR. I/O caps are necessary for our test equipment and may not be needed for your application

### PART NUMBER STRUCTURE

**U CH - 5 / 30 - D48 N B H - C**

**Output Configuration:** Unipolar Single Output

**Half-brick package**

**Nominal Output Voltage**

**Maximum Rated Output:** Current in Amps

**Input Voltage Range:**
**D24** = 18-36 Volts
**D48** = 36-75 Volts

**On/Off Control Polarity**
**P =** Positive polarity (standard for D24, optional for D48)
**N =** Negative polarity (standard for D48, optional for D24)

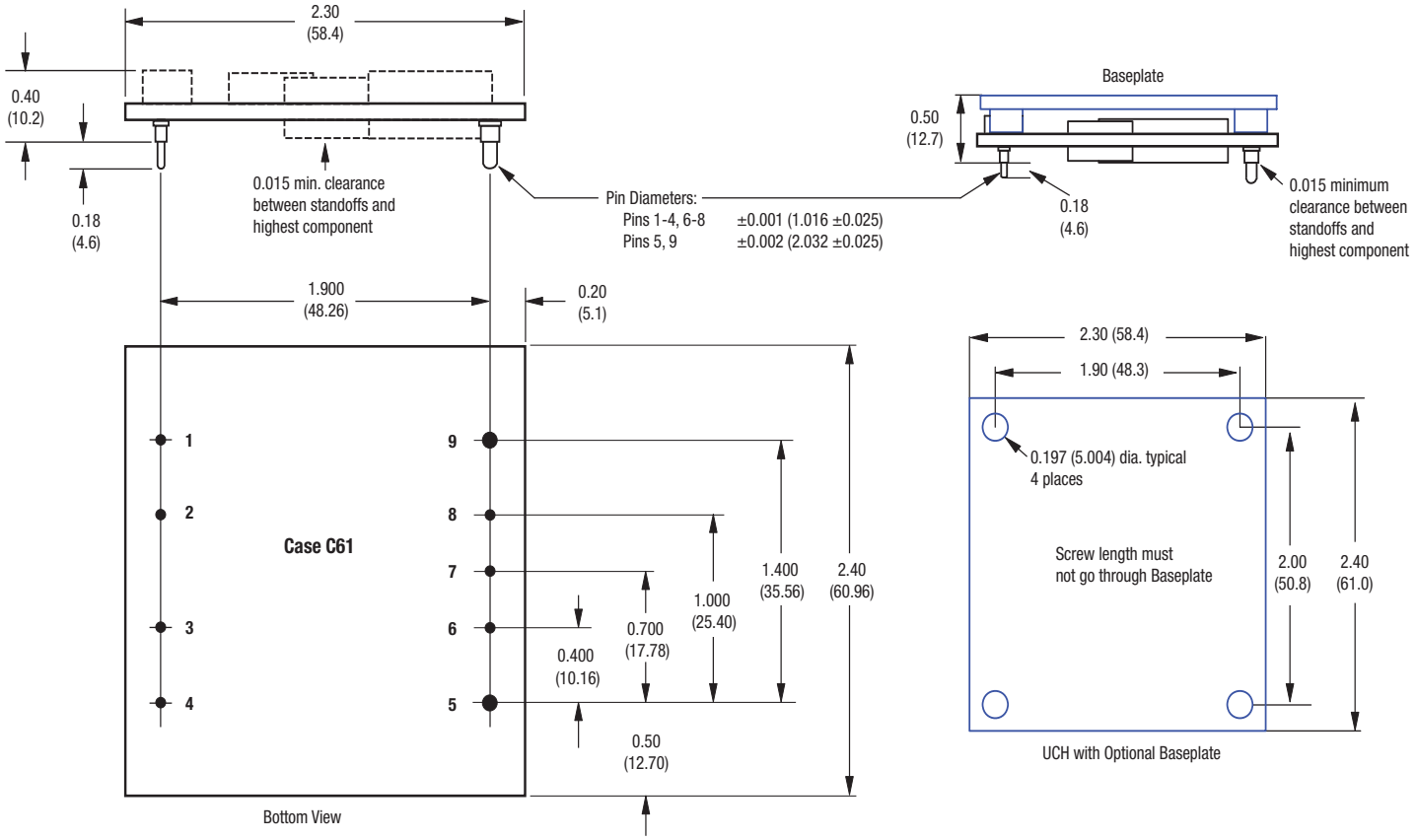
**Optional Baseplate**
**Blank =** No Baseplate, standard
**B =** Baseplate installed, optional quantity order

**Optional Conformal Coating**
**Blank =** No coating, standard
**H =** Coating added, optional special order

**RoHS Hazardous Materials Compliance**
**C =** RoHS-6 (no lead), standard
**Y =** RoHS-5 (with lead), optional, special order

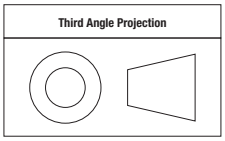
**Note:** Some model number combinations may not be available. Contact Murata Power Solutions for availability.

## MECHANICAL SPECIFICATIONS




| INPUT/OUTPUT CONNECTIONS | |
|---|---|
| **Pin** | **Function P17** |
| 1 | –Input |
| 2 | Case |
| 3 | On/Off Control |
| 4 | +Input |
| 5 | +Output |
| 6 | +Sense |
| 7 | Trim |
| 8 | –Sense |
| 9 | –Output |

Dimensions are in inches (mm shown for ref. only).




Tolerances (unless otherwise specified):
.XX ± 0.02 (0.5)
.XXX ± 0.010 (0.25)
Angles ± 2˚

Components are shown for reference only.

## Performance Specifications and Ordering Guide ①

| | UCH-1.8/40-D48 | UCH-2.5/40-D48 | UCH-3.3/10-D24 | UCH-3.3/10-D48 | UCH-3.3/15-D48 | UCH-3.3/35-D24 | UCH-3.3/30-D48 |
|---|---|---|---|---|---|---|---|
| **Input** | | | | | | | |
| Input voltage range | See ordering guide | | | | | | |
| Start-up threshold, Volts | 34 | 34 | 16 | 34 | 34 | 16 | 34 |
| Undervoltage shutdown, V | 32 | 31 | 15 | 31 | 31 | 15 | 31 |
| Overvoltage shutdown | none | | | | | | |
| Reflected (back) ripple current, mA pk-pk | 10 | 20 | 10 | 15 | 15 | 15 | 10 |
| | | | | | | | |
| **Input Current** | | | | | | | |
| Full load conditions | See ordering guide. | | | | | | |
| Inrush transient, $A^2$sec | 0.05 | | | | | | |
| Output short circuit, mA | 50 | | | | | | |
| No load, mA | 50 | 100 | | | | | |
| Low line ($V_{IN}$ = min.), Amps | 2.30 | 1.54 | 2.06 | 1.03 | 1.54 | 7.21 | 3.09 |
| Standby mode, mA (Off, UV, OT shutdown) | 2 | 10 | | | | | 8 |
| Internal input filter type | Pi | L-C | | | | | |
| External recommended fuse, Amps | 10 | 3 | 5 | 3 | 3 | 12.5 | 7.5 |
| Reverse polarity protection | See notes. | | | | | | |
| | | | | | | | |
| **Remote On/Off Control** | | | | | | | |
| Positive logic (P model suffix) | OFF = Ground pin to +1V max.<br>ON = Open or +3.5 to +15V max | | | | | | |
| Negative logic (N model suffix) | OFF = Open or +2.5V to +1V max.<br>ON = –0.1V to +0.8V max | | | | | | |
| Current, mA | 1 | | | | | | |
| | | | | | | | |
| **Output** | | | | | | | |
| Voltage output range | See ordering guide. | | | | | | |
| Voltage output accuracy | ±1% of $V_{NOM}$ (50% load) | | | | | | |
| Adjustment range | –10 to +10% of $V_{NOM}$. | | | | | | |
| Temperature coefficient over oper. temp. range | ±0.02% of $V_{OUT}$ range per °C | | | | | | |
| Minimum loading | No minimum loading. | | | | | | |
| Remote sense compensation | +10%. | | | | | | |
| Ripple/noise (20 MHz bandwidth) | See ordering guide. | | | | | | |
| Line/Load regulation | See ordering guide. | | | | | | |
| Efficiency | See ordering guide. | | | | | | |
| Maximum capacitive loading, Low ESR <0.02Ω max., resistive load, µF | 10,000 max. | | | | | | |

| | UCH-5/10-D48 | UCH-5/20-D24 | UCH-5/30-D48 | UCH-12/4.2-D48 | UCH-12/12.5-D48 | UCH-15/6.7-D48 |
|---|---|---|---|---|---|---|
| **Input** | | | | | | |
| Input voltage range | See ordering guide. | | | | | |
| Start-up threshold, Volts | 34 | 16 | 35 | 35 | 35 | 35 |
| Undervoltage shutdown, V | 33 | 15 | 34 | 33.5 | 33.5 | 33 |
| Overvoltage shutdown | none | | | | | |
| Reflected (back) ripple current, mA pk-pk | 15 | 20 | 15 | 20 | 20 | 20 |
| | | | | | | |
| **Input Current** | | | | | | |
| Full load conditions | See ordering guide. | | | | | |
| Inrush transient, $A^2$sec | 0.05 | | | | | |
| Output short circuit, mA | 50 | | | | | |
| No load, mA | 100 | | | 90 | | |
| Low line ($V_{IN}$ = min.), Amps | 1.54 | 6.17 | 4.63 | 1.51 | 4.47 | 3.06 |
| Standby mode, mA (Off, UV, OT shutdown) | 4 | 10 | 4 | 1 | | |
| Internal input filter type | Pi | L-C | | Pi | L-C | |
| External recommended fuse, Amps | 10 | 10 | 7.5 | 10 | 7.5 | |
| Reverse polarity protection | See notes. | | | | | |
| | | | | | | |
| **Remote On/Off Control** | | | | | | |
| Positive logic (P model suffix) | OFF = Ground pin to +1V max.<br>ON = Open or +3.5 to +15V max | | | | | |
| Negative logic (N model suffix) | OFF = Open or +2.5V to +1V max.<br>ON = –0.1V to +0.8V max | | | | | |
| Current, mA | 1 | | | | | |
| | | | | | | |
| **Output** | | | | | | |
| Voltage output range | See ordering guide. | | | | | |
| Voltage output accuracy | ±1% of $V_{NOM}$. | | | | | |
| Adjustment range | –10 to +10% of $V_{NOM}$. | | | | | |
| Temperature coefficient over oper. Temp. range | ±0.02% of $V_{OUT}$ range per °C | | | | | |
| Minimum loading | No minimum loading. | | | | | |
| Remote sense compensation | +10%. | | | | | |
| Ripple/noise (20 MHz bandwidth) | See ordering guide. | | | | | |
| Line/Load regulation | See ordering guide. | | | | | |
| Efficiency | See ordering guide. | | | | | |
| Maximum capacitive loading, Low ESR <0.02Ω max., resistive load, µF | 10,000 | 10,000 max. | 20,000 max. | 5000 | 10,000 | 1,000 |

| | UCH-1.8/40-D48 | UCH-2.5/40-D48 | UCH-3.3/10-D24 | UCH-3.3/10-D48 | UCH-3.3/15-D48 | UCH-3.3/35-D24 | UCH-3.3/30-D48 |
|---|---|---|---|---|---|---|---|
| **Isolation Voltage** | | | | | | | |
| Input to Output, Volts min. | 2250 | | | | | | |
| Input to baseplate, Volts min. | 1500 | | | | | | |
| Baseplate to output, Volts min. | 1500 | | | | | | |
| Isolation resistance, MΩ | 100 | | | | | | |
| Isolation capacitance, pF | 1000 | | | | | | |
| Isolation safety rating | Basic insulation | | | | | | |
| Current limit inception (98% of $V_{OUT}$, after warmup), Amps | 56 max. | 49 | 15 | 15 | 19 | 40 | 35 |
| Short circuit protection method | Current limiting, hiccup autorestart. Remove overload for recovery. | | | | | | |
| Short circuit current, Amps | 5 | | | | | | |
| Short circuit duration | Output may be shorted continuously to ground (no damage). | | | | | | |
| Overvoltage protection, Volts (via magnetic feedback) | 2.7 max. | 3.75 max. | 4.95 V max | | | 4.62 max. | 4.95 max. |
| Prebiased Startup | Starts if external voltage is less than $V_{NOM}$. | | | | | | |
| | | | | | | | |
| **Dynamic characteristics** | | | | | | | |
| Dynamic load response (50-75-50% load step) | 100 µSec to ±1% of final value | 100 µSec to ±1% of final value | 200 µSec to ±1% of final value | 200 µSec to ±1% of final value | 200 µSec to ±1% of final value | 200 µSec to ±1% of final value | 200 µSec to ±1% of final value |
| Start-up time | | | | | | | |
| $V_{IN}$ to $V_{OUT}$ regulated, mSec | 10 max. | 50 max. | | | | | |
| Remote On/Off to $V_{OUT}$ regulated, mSec | 10 max. | 50 max. | | | | | |
| Switching frequency, KHz | 360 | 420 ± 40 | 330 ± 40 | | | | |
| | | | | | | | |
| **Environmental** | | | | | | | |
| Calculated MTBF | 1.6M hrs. | TBD | | | | | |
| Operating temperature range (with derating) | –40 to +85 (See Derating Curves) | | | | | | |
| Operating temperature, with baseplate °C (no derating required) | –40 to +110 | –40 to +120 | | | | | |
| Storage temperature range, °C | –55 to +125 | | | | | | |
| Thermal protection/shutdown, °C | +115 | +115 | +120 | | | | |
| Relative humidity | To +85°C/85%, non-condensing | | | | | | |

| | UCH-5/10-D48 | UCH-5/20-D24 | UCH-5/30-D48 | UCH-12/4.2-D48 | UCH-12/12.5-D48 | UCH-15/6.7-D48 |
|---|---|---|---|---|---|---|
| **Isolation Voltage** | | | | | | |
| Input to Output, Volts min. | 2250 | | | | | |
| Input to baseplate, Volts min. | 1500 | | | | | |
| Baseplate to output, Volts min. | 1500 | | | | | |
| Isolation resistance, MΩ | 100 | | | | | |
| Isolation capacitance, pF | 1000 | | | | | |
| Isolation safety rating | Basic insulation | | | | | |
| | | | | | | |
| **Miscellaneous** | | | | | | |
| Current limit inception (98% of $V_{OUT}$, after warmup), Amps | 13 | 26 | 35 | 5.4 | 14.5 | 7.4 |
| Short circuit protection method | Current limiting, hiccup autorestart. Remove overload for recovery. | | | | | |
| Short circuit current, Amps | 5 | | | | | |
| Short circuit duration | Output may be shorted continuously to ground (no damage). | | | | | |
| Overvoltage protection, Volts (via magnetic feedback) | 7.75 max. | 7.5 max. | 7.5 | 18 max. | 16.8 max. | 17.5 |
| Prebiased Startup | Starts if external voltage is less than $V_{NOM}$. | | | | | |
| | | | | | | |
| **Dynamic characteristics** | | | | | | |
| Dynamic load response (50-75-50% load step) | 200 µSec to ±1% of final value | 200 µSec to ±1% of final value | 200 µSec to ±1% of final value | 250 µSec to ±1% of final value | 250 µSec to ±1% of final value | 250 µSec to ±1% of final value |
| Start-up time | | | | | | |
| $V_{IN}$ to $V_{OUT}$ regulated, mSec | 50 max. | | | | | |
| Remote On/Off to $V_{OUT}$ regulated, mSec | 50 max. | | | | | |
| Switching frequency, KHz | 300 ± 30 | 330 ± 40 | 300 ± 30 | 335 ± 35 | 335 ± 35 | 350 ± 40 |
| | | | | | | |
| **Environmental** | | | | | | |
| Calculated MTBF | 1.6M hours | TBD | | 1.6M hours | TBD | |
| Operating temperature range (with derating) | –40 to +85 (See Derating Curves) | | | | | |
| Operating temperature, with baseplate °C (no derating required) | –40 to +120 | | | | | |
| Storage temperature range, °C | –55 to +125 | | | | | |
| Thermal protection/shutdown, °C | +120 | | | | | +115 |
| Relative humidity | To +85°C/85%, non-condensing | | | | | |

| | UCH-1.8/40-D48 | UCH-2.5/40-D48 | UCH-3.3/10-D24 | UCH-3.3/10-D48 | UCH-3.3/15-D48 | UCH-3.3/35-D24 | UCH-3.3/30-D48 |
|---|---|---|---|---|---|---|---|
| **Physical** | | | | | | | |
| Outline dimensions | See mechanical specs. | | | | | | |
| Baseplate material | Aluminum | | | | | | |
| Pin material | Gold plated copper alloy with nickel underplate | | | | | | |
| Pin diameter | 0.04/0.08 inches (1.016/2.032 mm) | | | | | | |
| Weight, ounces | 1.68 | | 2 | | | | |
| Weight, grams | 47 | | 60 | | | | |
| Electromagnetic interference (conducted and radiated) (external filter required) | FCC part 15, class B, EN55022 | | | | | | |
| Flammability | UL94V-0 | | | | | | |
| Safety | UL 60950-1, CSA C22.2 No.60950-1, IEC/EN 60950-1 | | | | | | |

| | UCH-5/10-D48 | UCH-5/20-D24 | UCH-5/30-D48 | UCH-12/4.2-D48 | UCH-12/12.5-D48 | UCH-15/6.7-D48 |
|---|---|---|---|---|---|---|
| **Physical** | | | | | | |
| Outline dimensions | See mechanical specs. | | | | | |
| Baseplate material | Aluminum | | | | | |
| Pin material | Gold plated copper alloy with nickel underplate | | | | | |
| Pin diameter | 0.04/0.08 inches (1.016/2.032 mm) | | | | | |
| Weight, ounces | 2 | | | 1.73 | | |
| Weight, grams | 60 | | | 49 | | |
| Electromagnetic interference (conducted and radiated) (external filter required) | FCC part 15, class B, EN55022 | | | | | |
| Flammability | UL94V-0 | | | | | |
| Safety | UL 60950-1, CSA C22.2 No.60950-1, IEC/EN 60950-1 | | | | | |

## Trim Equations

**Trim Down**
Connect trim resistor between trim pin and –Sense

$$R_{TrimDn}\,(k\Omega) = \frac{1}{\Delta} - 2$$

**Where,**

$$\Delta = \frac{V_{NOMINAL} - V_{OUT}}{V_{NOMINAL}}$$

**Trim Up**
Connect trim resistor between trim pin and +Sense

$$R_{TrimUp}\,(k\Omega) = \frac{V_{NOMINAL} \times (1 + \Delta)}{1.225 \times \Delta} - \frac{1}{\Delta} - 2$$

**Where,**

$$\Delta = \frac{V_{OUT} - V_{NOMINAL}}{V_{NOMINAL}}$$

$V_{NOM}$ is the nominal, untrimmed output voltage.
$V_{OUT}$ is the desired new output voltage.

Do not exceed the specified trim range or maximum power ratings when adjusting trim. Use 1% precision resistors mounted close to the converter on short leads.

## Trim Circuits

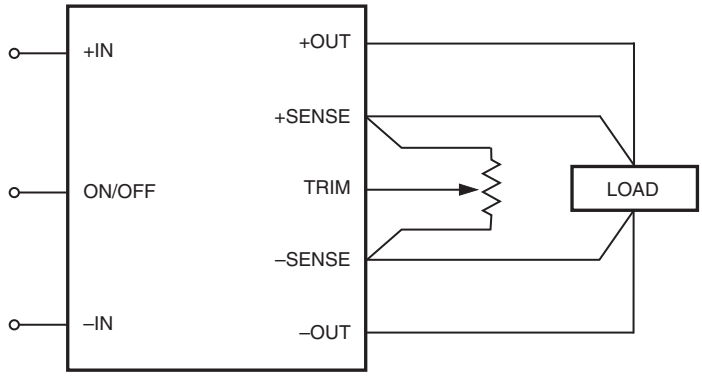



**Figure A. Trim Connections Using A Trimpot**

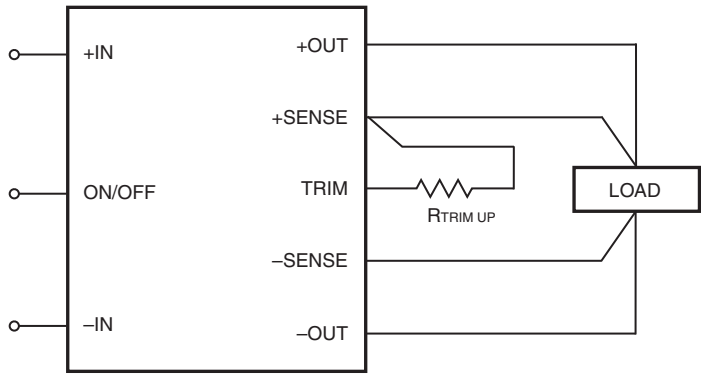



**Figure B. Trim Connections To Increase Output Voltages**

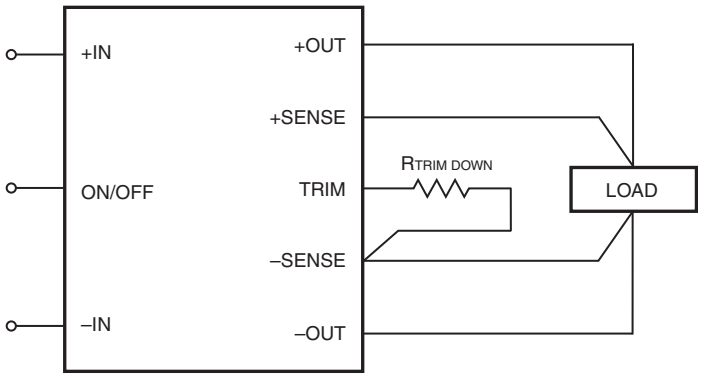
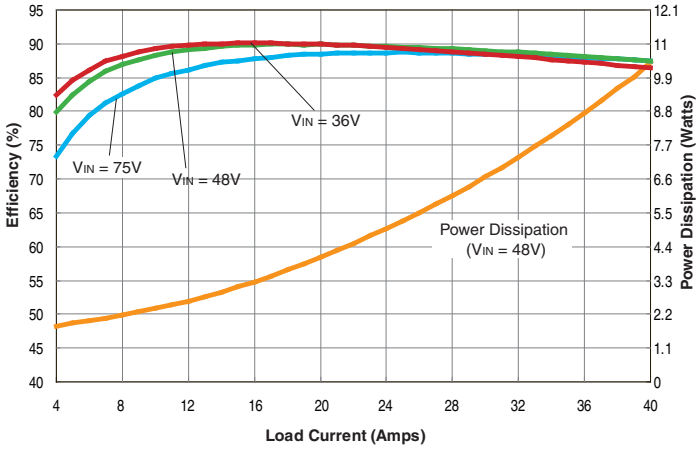


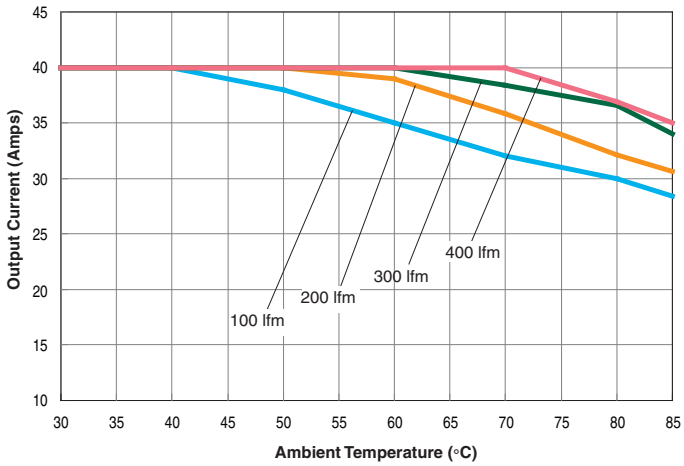

**Figure C. Trim Connections To Decrease Output Voltages**

## Typical Performance Curves

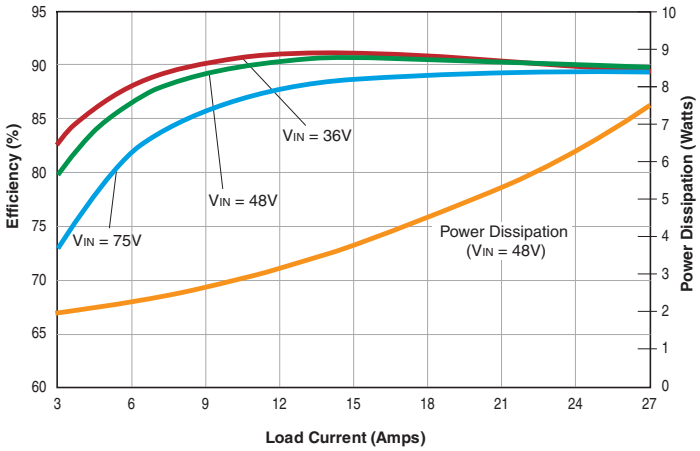
**UCH-1.8/40-D48 Efficiency and Power Dissipation vs Line Voltage and Load Current @25˚C**



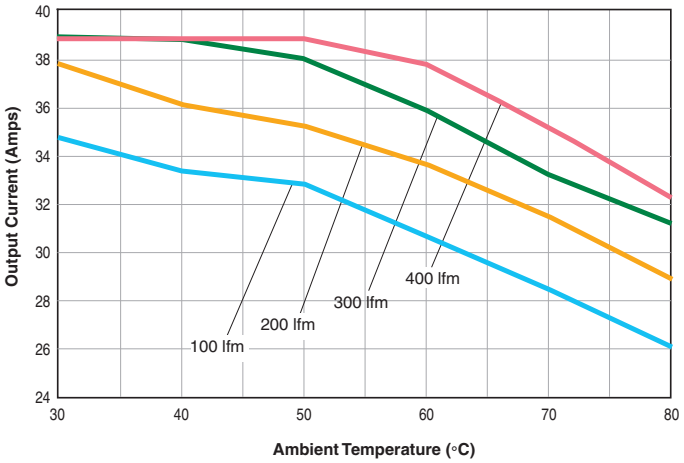

**UCH-1.8/40-D48 Maximum Current Temperature Derating** (at sea level)
No baseplate, $V_{IN}$ = 48V, airflow is from $V_{IN}$ to $V_{OUT}$



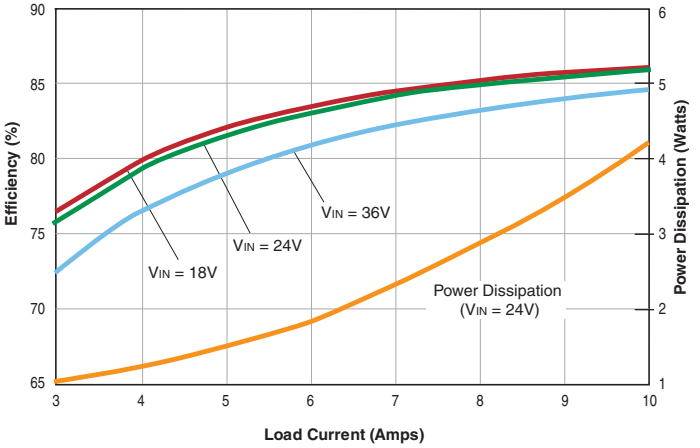

**UCH-2.5/40-D48 Efficiency and Power Dissipation vs Line Voltage and Load Current @25˚C**



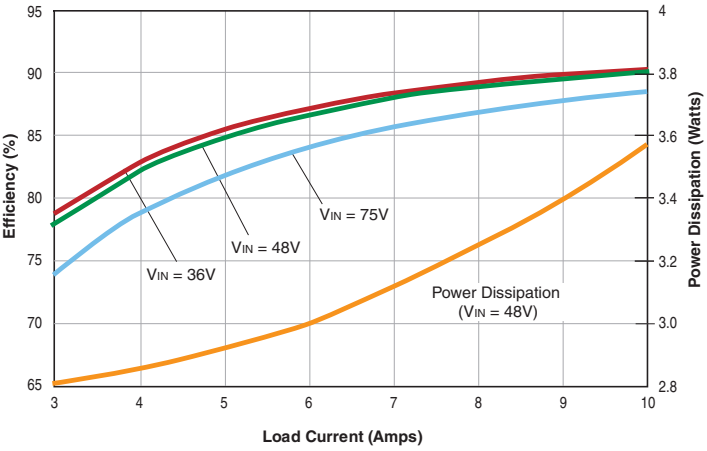

**UCH-2.5/40-D48 Maximum Current Temperature Derating** (at sea level)
No baseplate, $V_{IN}$ = 48V, transverse airflow




**UCH-3.3/10-D24 Efficiency and Power Dissipation vs Line Voltage and Load Current @25˚C**

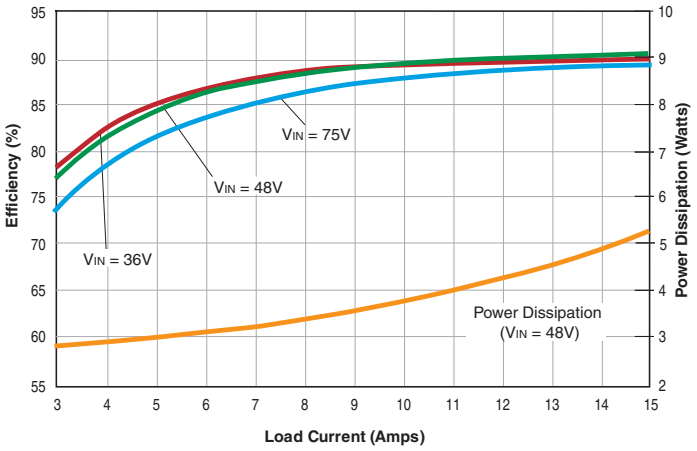



**UCH-3.3/10-D48 Maximum Current Temperature Derating vs Line Voltage and Load Current @25˚C**

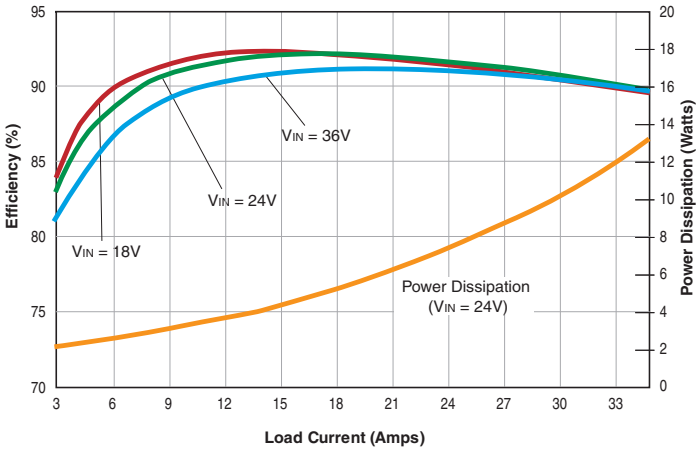


## Typical Performance Curves

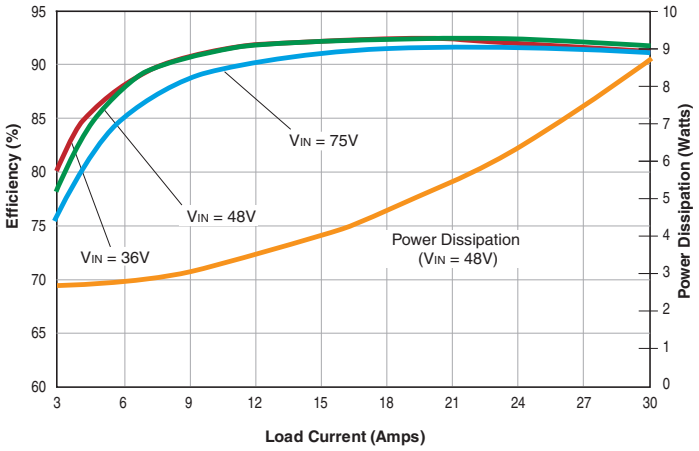
**UCH-3.3/15-D48 Efficiency and Power Dissipation vs Line Voltage and Load Current @25˚C**



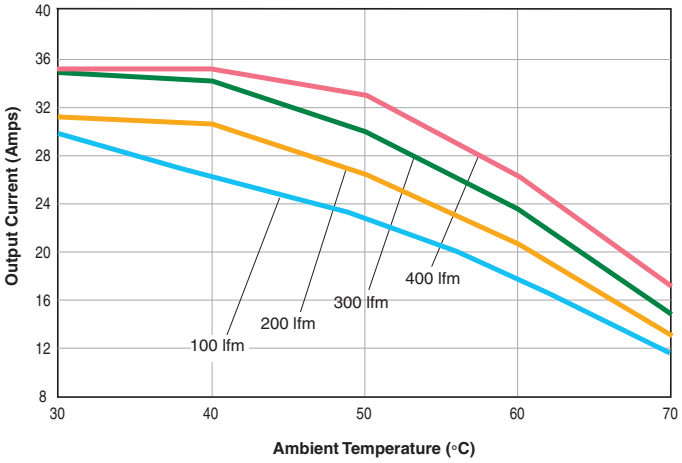

**UCH-3.3/35-D24 Efficiency and Power Dissipation vs Line Voltage and Load Current @25˚C**



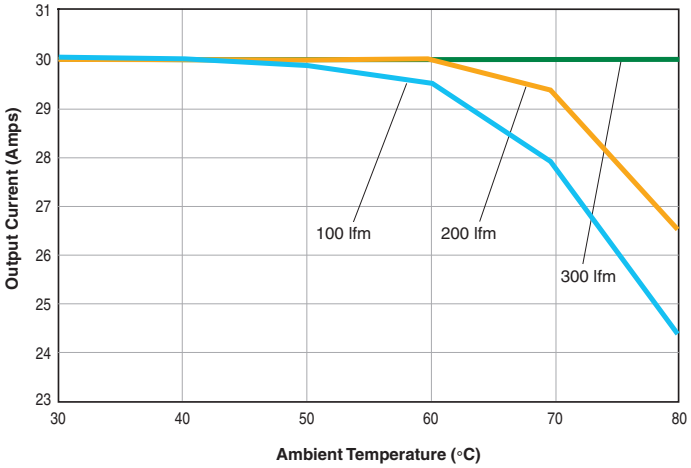

**UCH-3.3/30-D48 Efficiency and Power Dissipation vs Line Voltage and Load Current @25˚C**




**UCH-3.3/35-D24 Maximum Current Temperature Derating** (at sea level)
No baseplate, VIN = 24V, transverse airflow

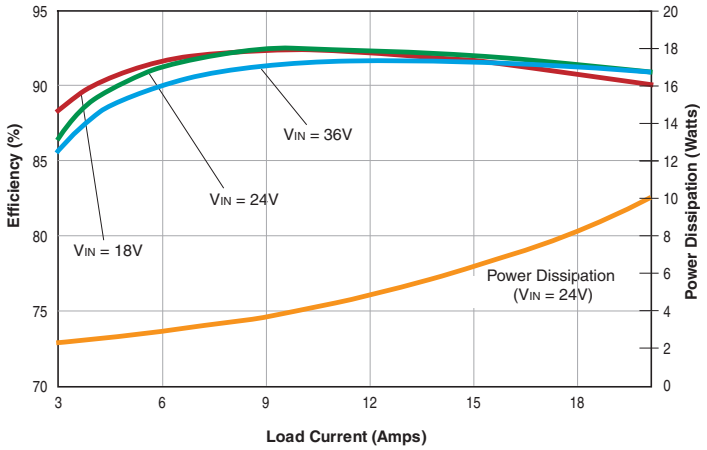



**UCH-3.3/30-D48 Maximum Current Temperature Derating** (at sea level)
No baseplate, VIN = 48V, transverse airflow

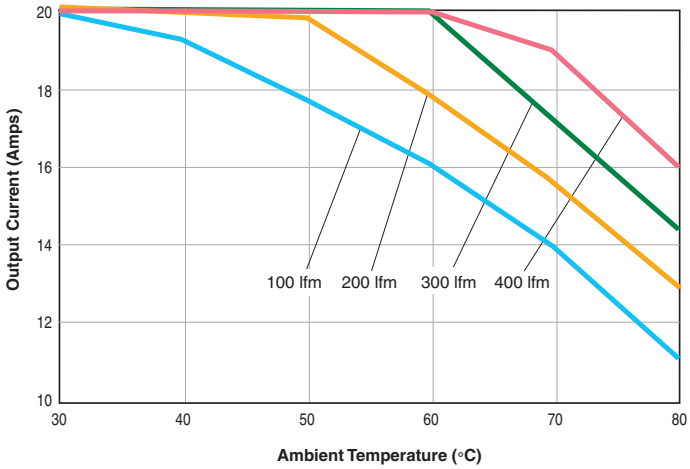


## Typical Performance Curves

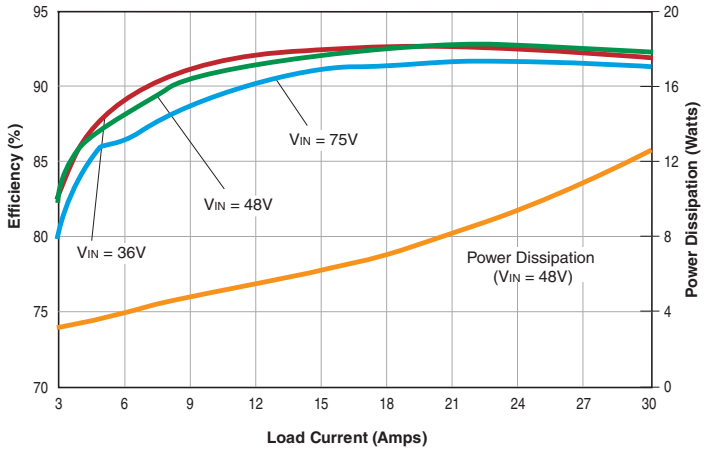
**UCH-5/20-D24 Efficiency and Power Dissipation vs Line Voltage and Load Current @25˚C**



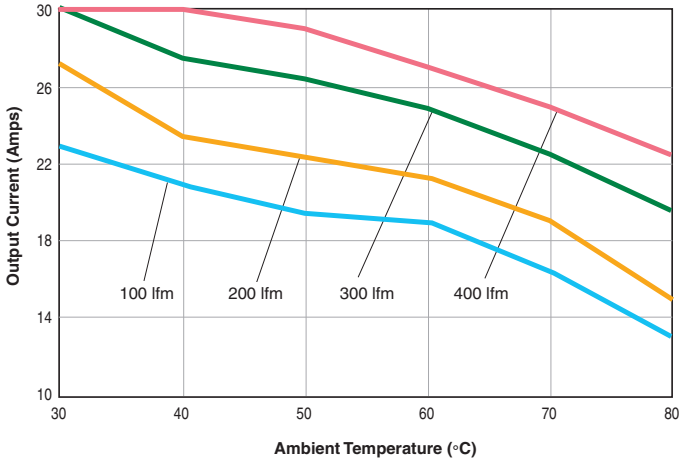

**UCH-5/20-D24 Maximum Current Temperature Derating** (at sea level)
No baseplate, VIN = 24V, transverse airflow



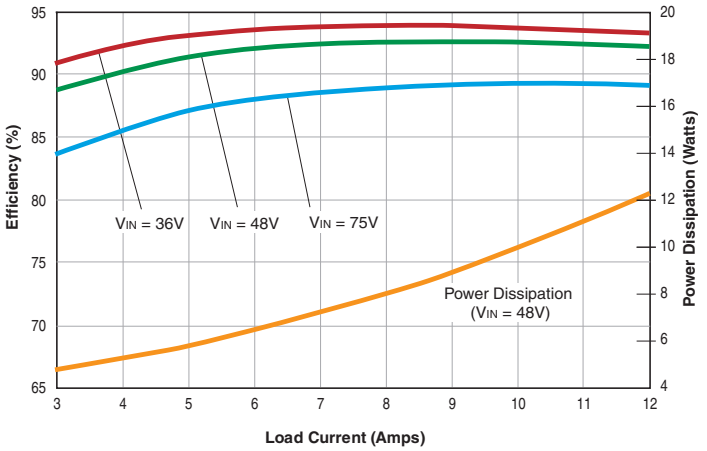

**UCH-5/30-D48 Efficiency and Power Dissipation vs Line Voltage and Load Current @25˚C**



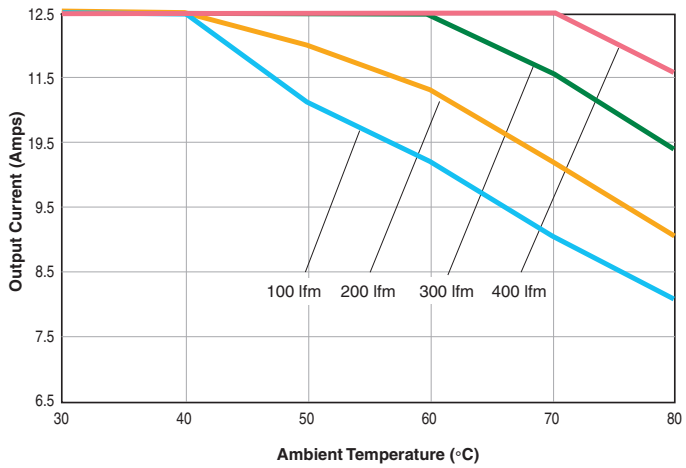

**UCH-5/30-D48 Maximum Current Temperature Derating** (at sea level)
No baseplate, VIN = 48V, transverse airflow




**UCH-12/12.5-D48 Efficiency and Power Dissipation vs Line Voltage and Load Current @25˚C**

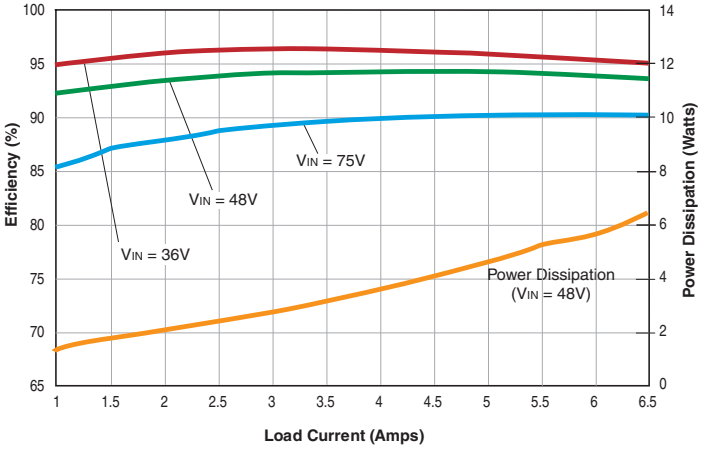



**UCH-12/12.5-D48 Maximum Current Temperature Derating** (at sea level)
No baseplate, VIN = 48V, transverse airflow

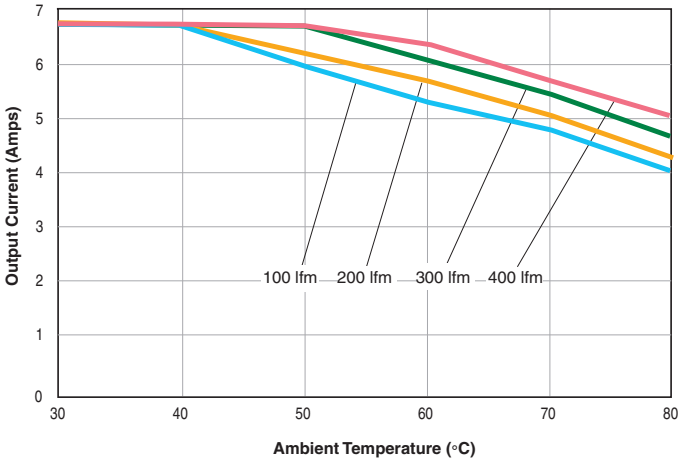


## Typical Performance Curves

**UCH-15/6.7-D48 Efficiency and Power Dissipation vs Line Voltage and Load Current @25˚C**




**UCH-15/6.7-D48 Maximum Current Temperature Derating** (at sea level)
No baseplate, $V_{IN}$ = 48V, transverse airflow

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