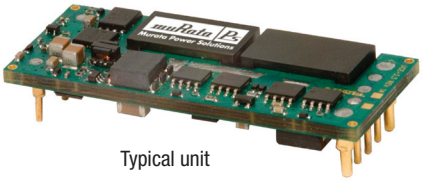
Murata Power Solutions

UCE Series

Isolated, High-Density, Eighth-Brick 100W DC/DC Converters



Typical unit

FEATURES

- RoHS compliant
- Industry standard eighth-brick pinout and package
- Outputs from 1.5V to 12V up to 100W
- Low profile 0.4" height with 0.9" x 2.3" outline dimensions
- 36 to 75 Vdc input range (48V nominal)
- Fully isolated, 2250 Vdc (BASIC) insulation
- Outstanding thermal performance and derating
- Extensive self-protection and short circuit features with no output reverse conduction
- On/Off control, trim and sense functions
- Interleaved synchronous rectification yields high efficiency over 90%
- Fully protected against temperature and voltage limits
- Designed to meet UL/EN/IEC 60950-1 and CAN/CSA C22.2 No. 60950-1 safety approvals

For efficient, fully isolated DC power in the smallest space, the UCE open frame DC/DC converter series fit in industry-standard “eighth brick” outline dimensions and mounting pins (on quarter-brick pinout).

PRODUCT OVERVIEW

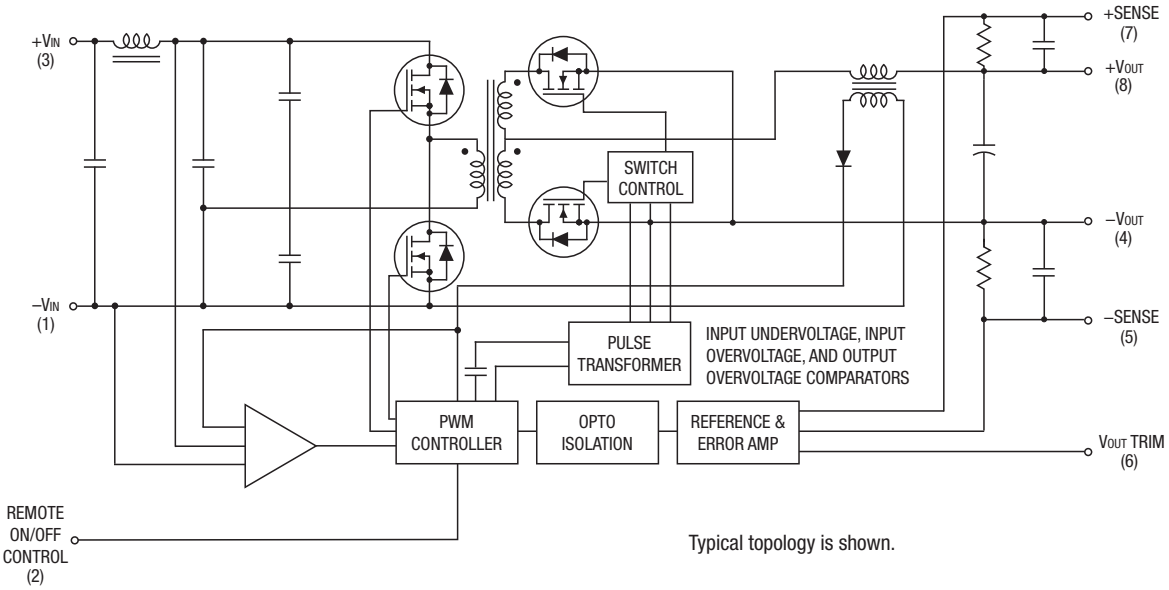
Units are offered with fixed output voltages from 1.5 to 12 Volts and currents up to 40 Amps. UCEs operate over a wide temperature range (up to +85 degrees Celsius at moderate airflow) with full rated power. Interleaved synchronous rectifier topology yields excellent efficiency over 90% and no reverse output conduction.

UCE’s achieve these impressive mechanical and environmental specs while delivering excellent electrical performance in a through-hole package. Overall noise is typically 50 mV pk-pk (low voltage models) with fast step response. These converters offer tight output regulation and high stability even with no load. The unit is fully protected against input undervoltage, output overcurrent and short circuit. An on-board temperature sensor shuts down the converter if thermal limits are reached. “Hiccup” output protection automatically restarts the converter when the fault is removed.

A convenient remote On/Off control input enables phased startup and shutdown in multi-voltage applications. To compensate for longer wiring and to retain output voltage accuracy at the load, UCEs employ a Sense input to dynamically correct for ohmic losses. A trim input may be connected to a user’s adjustment potentiometer or trim resistors for output voltage calibration. The UCE will tolerate substantial capacitive loading for bypass-cap applications.

UCEs include industry-standard safety certifications and BASIC I/O insulation provides input/output isolation to 2250V. Radiation emission testing is performed to widely-accepted EMC standards.

SIMPLIFIED BLOCK DIAGRAM



Typical topology is shown.

RoHS COMPLIANT 2002/95/EC

25

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

PERFORMANCE SPECIFICATIONS AND ORDERING GUIDE

Model Family	Output							Input				Efficiency		Package	
	V_{OUT} (V)	I_{OUT} (A)	Power (W)	Ripple & Noise (mVp-p) Typ.	Ripple & Noise (mVp-p) Max.	Regulation Line	Regulation Load	V_{IN} Nom. (V)	Range (V)	I_{IN}, no load (mA)	I_{IN}, full load (A)	Min.	Typ.	Case	Pinout
UCE-1.2/40-D48N-C	1.2	40	48	Please contact Murata Power Solutions for further information.											
UCE-1.5/20-D48N-C	1.5	20	30	50	100	±0.15%	±0.3%	48	36-75	50	0.72	85%	87%	C56	P32
UCE-1.5/40-D48N-C	1.5	40	60	Please contact Murata Power Solutions for further information.											
UCE-1.8/30-D48N-C	1.8	30	54	30	80	±0.125%	±0.25%	48	36-75	45	1.28	87%	88%	C56	P32
UCE-2.5/20-D48N-C	2.5	20	50	50	80	±0.125%	±0.25%			50	1.14	88%	91%		
UCE-2.5/40-D48N-C	2.5	40	100	Please contact Murata Power Solutions for further information.											
UCE-3.3/15-D48N-C	3.3	15	49.5	50	100	±0.125%	±0.25%	48	36-75	60	1.15	86%	90%	C56	P32
UCE-3.3/30-D48N-C	3.3	30	99			±0.1%	±0.2%				2.27	89%	91%		
UCE-5/10-D48N-C	5	10	50	50	100	±0.125%	±0.25%			30	1.15	88%	90.5%		
UCE-5/20-D48N-C	5	20	100	Please contact Murata Power Solutions for further information.											
UCE-12/4.2-D48N-C	12	4.2	50.4	150	300	±0.125%	±0.25%	48	36-75	50	1.14	86%	92%	C56	P32
UCE-12/8.3-D48N-C	12	8.3	99.6	200							2.31		90%		

① Please refer to the model number structure for additional ordering part numbers and options .

PART NUMBER STRUCTURE

U CE - 3.3 / 30 - D48 N B H - C

Output Configuration:
U = Unipolar/Single

Eighth-Brick Package

Nominal Output Voltage

Maximum Rated Output
Current in Amps

Input Voltage Range:
D48 = 36-75V,
48V nominal

On/Off Control Polarity
N = Negative polarity, standard
P = Positive polarity, optional

Baseplate (optional, not available on some models)
Blank = No baseplate, standard
B = Baseplate installed, optional, special quantity order

Conformal coating (optional)
Blank = no coating, standard
H = Coating added, optional, special quantity order

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

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

SPECIFICATIONS

INPUT CHARACTERISTICS

Model Family	V_{IN} (Volts) nominal	Start-up threshold Min. (A)	Under-voltage Shut-down (V)	Reflected (back) Ripple Current (mA)	Inrush Transient A^2sec	Output Short Circuit (mA)	Low Line (V_{IN}=min.) (A)	Standby Mode (mA)	Internal Input Filter Type	Reverse Polarity Protection	Remote On/Off Control		
											Current (mA)	Positive Logic "P" Model Suffix	Negative Logic "N" Model Suffix
UCE-1.5/20-D48	48	34	32	10-30, model dependent	0.05 A^2sec	50-150, model dependent	0.97	1-10, model dependent	L-C	See notes	1.0	OFF=Ground pin to +1V max. ON=open or +3.5 to +15V max.	OFF=open or +2.5V to +15V max. ON=Ground pin to +0.8V max.
UCE-1.8/30-D48			32.5				1.72						
UCE-2.5/20-D48			32				1.53						
UCE-3.3/15-D48			32				1.54						
UCE-3.3/30-D48			32				3.06						
UCE-5/10-D48		34.5	32				1.53		Pi				
UCE-12/4.2-D48		34	32				1.52		L-C				
UCE-12/8.3-D48			32				3.07						

OUTPUT CHARACTERISTICS

Model Family	V_{OUT} V	V_{OUT} Accuracy 50% Load % of V_{NOM}	Capacitive Loading Max. Low ESR <0.02Ω Max. resistive load µF	Adjustment Range	Temperature Coefficient	Minimum Loading	Remote Sense Compen-sation	Ripple/ Noise (20 MHz bandwidth)	Line/Load Regulation	Efficiency	Current Limit Inception 98% of Vout, after warmup A
UCE-1.5/20-D48	1.5	±1%	10,000	–10 to +10% of Vnom.	±0.02% of Vout range per °C	No minimum load	+10%	See ordering guide			24.5
UCE-1.8/30-D48	1.8		10,000								36
UCE-2.5/20-D48	2.5		10,000								32
UCE-3.3/15-D48	3.3		10,000								24
UCE-3.3/30-D48	3.3		10,000								35
UCE-5/10-D48	5		1000								15.
UCE-12/4.2-D48	12		1000								5.5
UCE-12/8.3-D48	12		1000								12

ISOLATION CHARACTERISTICS

Model Family	Input to Output Min. V	Input to baseplate Min. V	Baseplate to output Min. V	Isolation Resistance MΩ	Isolation Capacitance pF	Isolation Safety Rating
UCE-1.5/20-D48	2250	1500	1500	100	1000	Basic Insulation
UCE-1.8/30-D48				10		
UCE-2.5/20-D48				100		
UCE-3.3/15-D48						
UCE-3.3/30-D48						
UCE-5/10-D48						
UCE-12/4.2-D48						
UCE-12/8.3-D48						

MISCELLANEOUS CHARACTERISTICS

Model Family	Calculated MTBF[4]	Operating Temperature Range with derating (°C)	Operating PCB Temperature (no derating)	Storage Temperature Range (°C)	Thermal Protection/ Shutdown (ºC)	Short Circuit Current (A)	Overvoltage Protection[12] (V) Via magnetic feedback (V)	Short Circuit Protection Method	Short Circuit Duration[16]	Relative Humidity (non-condensing)
UCE-1.5/20-D48	TBC	–40 to +85	–40 to +120	–55 to +125	120	5	1.95	Current limiting, hiccup autorestart. Remove overload for recovery.	Continuous, output shorted to ground. No damage.	to +85°C/85%
UCE-1.8/30-D48							2.8 V. max			
UCE-2.5/20-D48	1.8 M HRS						3			
UCE-3.3/15-D48	TBC						4.25			
UCE-3.3/30-D48										
UCE-5/10-D48	2.6 M HRS				110	0.5	7 max.			
UCE-12/4.2-D48	TBC				125	5	14.5			
UCE-12/8.3-D48	2.4 M HRS									

SPECIFICATIONS, CONTINUED

DYNAMIC CHARACTERISTICS

Model Family	Dynamic Load Response (50-75-50% load step) to 1% of final value	Start-up Time		Switching Frequency KHz
		V_{IN} to V_{OUT} regulated (Max.)	Remote On/ Off to V_{OUT} regulated (Max.)	
		mSec		
UCE-1.5/20-D48	100	50	50	480
UCE-1.8/30-D48	150	10	10	400 ±40
UCE-2.5/20-D48	100	50	50	350 ±20
UCE-3.3/15-D48	200	50	50	480 ±50
UCE-3.3/30-D48	50	15	10	380 ±40
UCE-5/10-D48	100	50	50	400 ±20
UCE-12/4.2-D48	30	60	60	200 ±10
UCE-12/8.3-D48	30	50	50	

ABSOLUTE MAXIMUM RATINGS

Input Voltage:	
Continuous:	
48 Volt input models	75 Volts
Transient (100 mSec. Max.)	
48 Volt input models	100 Volts
On/Off Control	+15 Volts
Input Reverse Polarity Protection	5 Amps, 10 sec. max.
Output Overvoltage Protection	Magnetic feedback. See specifications.
Output Current *	Current-limited. Devices can withstand sustained short circuit without damage.
Storage Temperature	–40 to +125°C.
Lead Temperature	+280°C, 10 seconds max.

Absolute maximums 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 nor recommended.

Note: Not all model combinations are available.

PERFORMANCE SPECIFICATION NOTES

(1) All models are tested and specified with external 1||10 µF ceramic/tantalum output capacitors and no external input capacitor. All capacitors are low ESR types. These capacitors are necessary to accommodate our test equipment and may not be required to achieve specified performance in your applications. All models are stable and regulate within spec under no-load conditions.

General conditions for Specifications are +25 deg.C, V_{IN} = nominal, V_{OUT} = nominal, full load. Adequate airflow must be supplied for extended testing under power.

(2) Input Ripple Current is tested and specified over a 5 Hz to 20 MHz bandwidth. Input filtering is C_{IN} = 33 µF, 100V tantalum, C_{BUS} = 220 µF, 100V electrolytic, L_{BUS} = 12 µH.

(3) Note that Maximum Power Derating curves indicate an average current at nominal input voltage. At higher temperatures and/or lower airflow, the DC/DC converter will tolerate brief full current outputs if the total RMS current over time does not exceed the Derating curve. All Derating curves are presented at sea level altitude. Be aware of reduced power dissipation with increasing density altitude.

(4) Mean Time Before Failure is calculated using the Telcordia (Belcore) SR-332 Method 1, Case 3, ground fixed conditions, Tpcboard=+25 deg.C, full output load, natural air convection.

(5) The On/Off Control is normally controlled by a switch. But it may also be driven with external logic or by applying appropriate external voltages which are referenced to Input Common. The On/Off Control Input should use either an open collector or open drain transistor.

(6) Short circuit shutdown begins when the output voltage degrades approximately 2% from the selected setting.

(7) The outputs are not intended to sink appreciable reverse current. This may damage the outputs.

(8) Output noise may be further reduced by adding an external filter. See I/O Filtering and Noise Reduction.

(9) All models are fully operational and meet published specifications, including “cold start” at –40ºC.

(10) Regulation specifications describe the deviation as the line input voltage or output load current is varied from a nominal midpoint value to either extreme.

(11) Alternate pin length and/or other output voltages are available under special quantity order.

(12) Output current limit is non-latching. When the overcurrent fault is removed, the converter will immediately recover.

(13) Do not exceed maximum power specifications when adjusting the output trim.

(14) At zero output current, the output may contain low frequency components which exceed the ripple specification. The output may be operated indefinitely with no load.

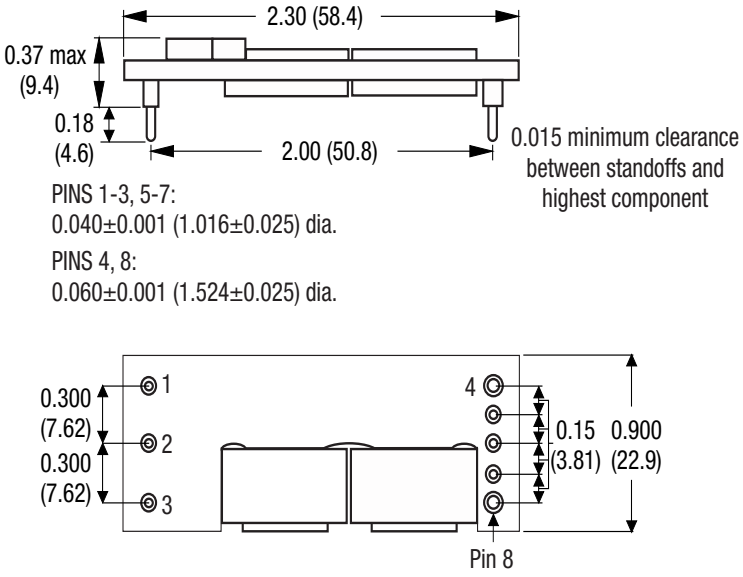
(15) If reverse polarity is accidentally applied to the input, a body diode will become forward biased and will conduct considerable current. To ensure reverse input protection with full output load, always connect an external input fuse in series with the $+V_{IN}$ input. Use approximately twice the full input current rating with nominal input voltage.

SPECIFICATIONS, CONTINUED

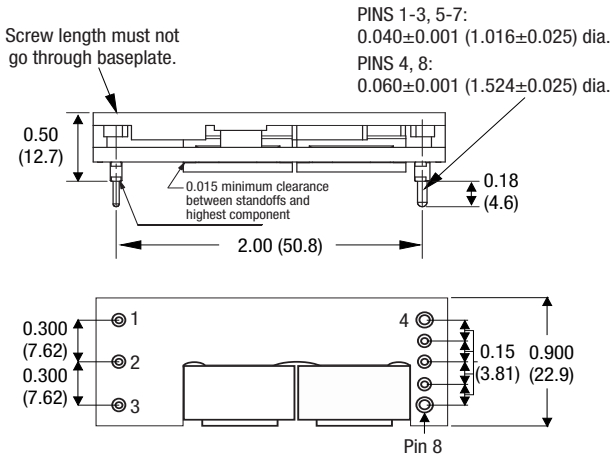
PHYSICAL CHARACTERISTICS		
Outline dimensions		See mechanical specs (below)
Pin material		Copper alloy
Pin diameter		0.04/0.062" (1.016/1.524mm)
Pin finish		Nickel underplate with gold overplate
Weight	UCE-1.5/20-D48	0.67 ounces (19 grams)
	UCE-1.8/30-D48,	0.71 ounces (20 grams)
	UCE-2.5/20-D48	
	UCE-5/10-D48	
	UCE-12/4.2-D48	
	UCE-3.3/15-D48	1 ounce (28 grams)
	UCE-3.3/30-D48, UCE-12/8.3-D48	0.81 ounces (23 grams)
Electromagnetic interference (conducted and radiated) (external filter required)		FCC part 15, class B, EN55022
Safety		Designed to meet UL/cUL 60950-1, CSA-C22.2 No. 60950-1, IEC/EN 60950-1

MECHANICAL SPECIFICATIONS

Without Baseplate

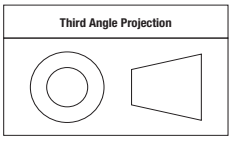


With Baseplate



Dimensions are in inches (mm).
Typical component locations are shown. Actual units may vary.

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.

INPUT/OUTPUT CONNECTIONS	
Pin	**Function P32**
1	–Input
2	On/Off Control
3	+Input
4	–Output
5	–Sense
6	Output Trim
7	+Sense
8	+Output

Trim Equations

Trim Down
Connect trim resistor between trim pin and –Sense

$$R_{TrimDn}\,(k\,\Omega) = \frac{5.11}{\Delta} - 10.22$$

Trim Up
Connect trim resistor between trim pin and +Sense

$$R_{TrimUp}\,(k\,\Omega) = \frac{5.11 \times V_{NOM} \times (1+\Delta)}{1.225 \times \Delta} - \frac{5.11}{\Delta} - 10.22$$

Where,

$\Delta = |\,(V_{NOM} - V_{OUT}) / V_{NOM}\,|$

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

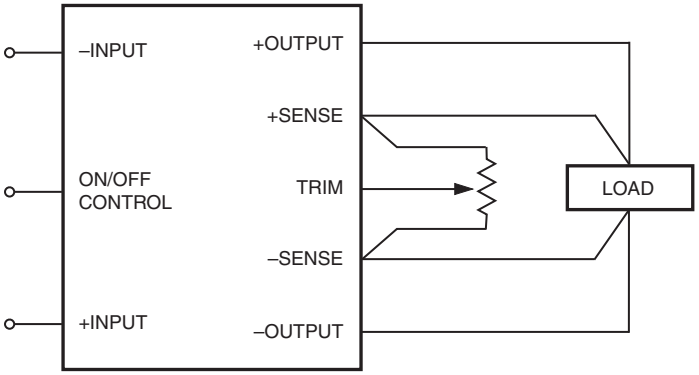


Figure A. Trim Connections Using A Trimpot

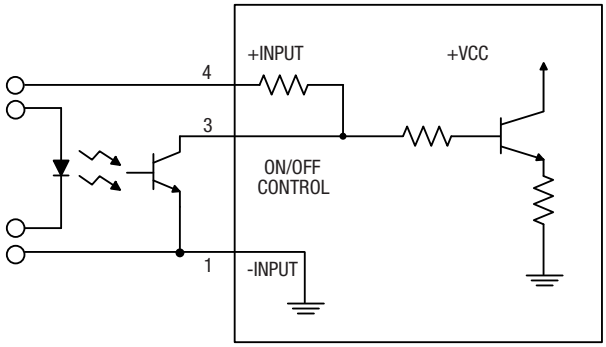


Figure C. Driving the On/Off Control Pin (suggested circuit)

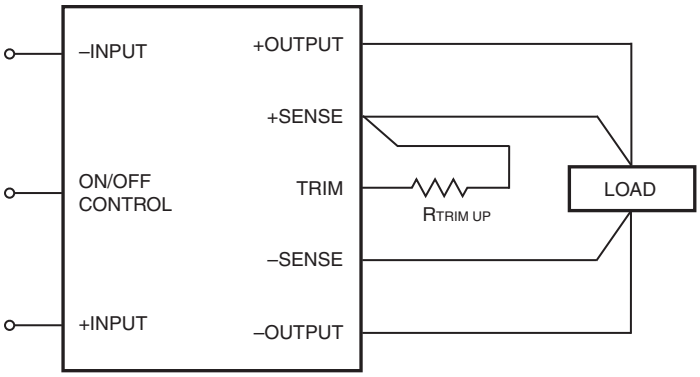


Figure B. Trim Connections To Increase Output Voltages

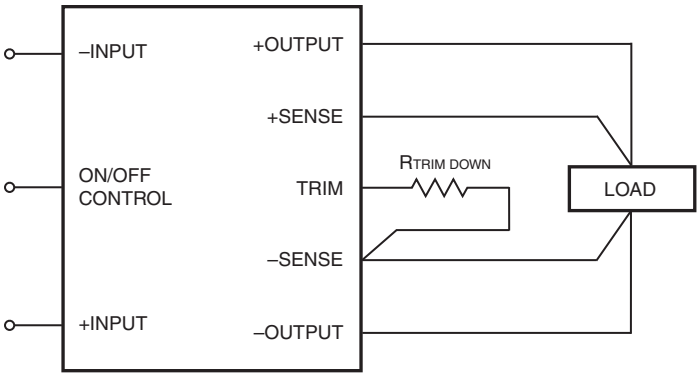
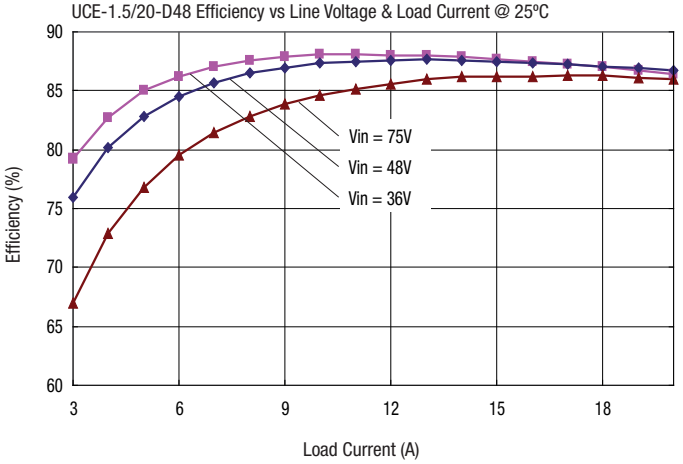


Figure D. Trim Connections To Decrease Output Voltages

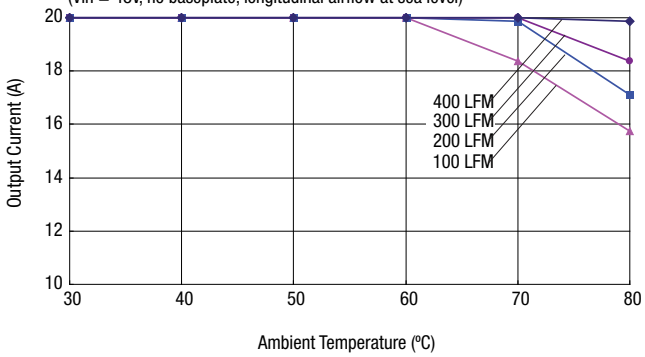
Connect sense to its respective V_{OUT} pin if sense is not used with a remote load.

Typical Performance Curves

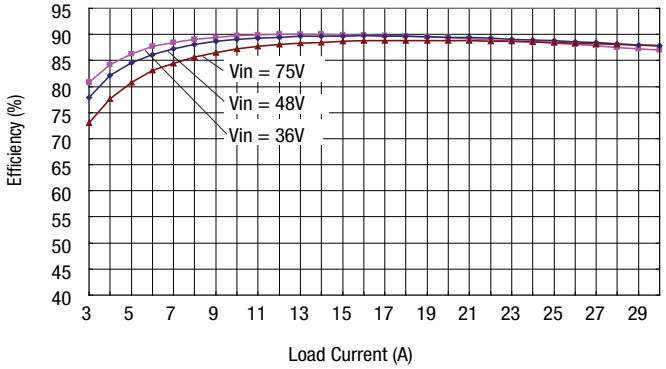
UCE-1.5/20-D48 Efficiency vs Line Voltage & Load Current @ 25ºC



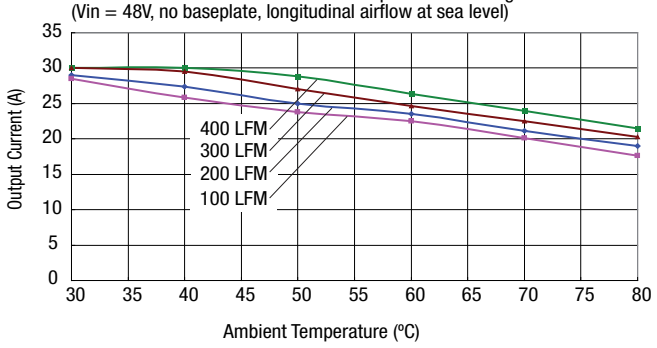
UCE-1.5/20-D48 Maximum Current Temperature Derating
(Vin = 48V, no baseplate, longitudinal airflow at sea level)



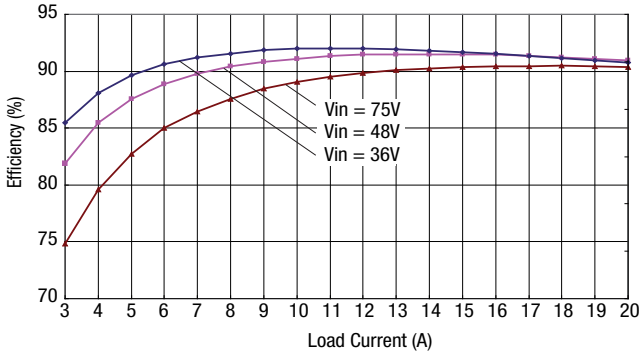
UCE-1.8/30-D48 Efficiency vs Line Voltage & Load Current @ 25ºC



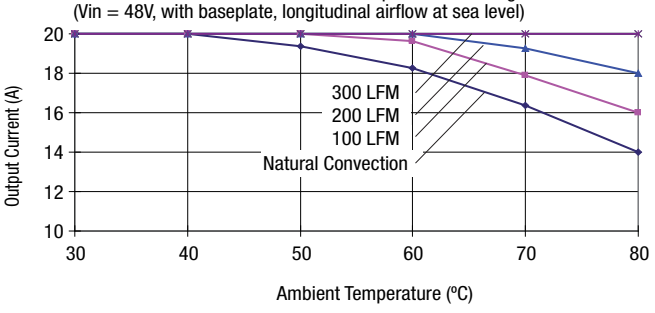
UCE-1.8/30-D48 Maximum Current Temperature Derating
(Vin = 48V, no baseplate, longitudinal airflow at sea level)



UCE-2.5/20-D48 Efficiency vs Line Voltage & Load Current @ 25ºC

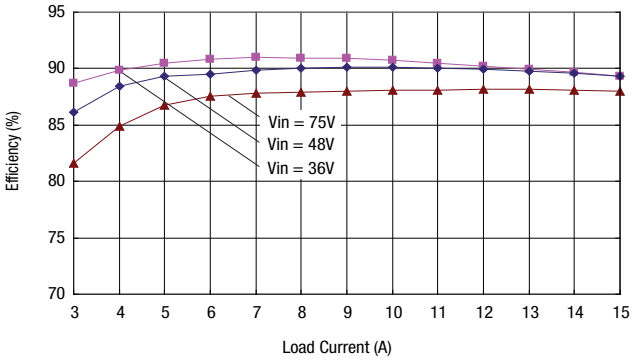


UCE-2.5/20-D48 Maximum Current Temperature Derating
(Vin = 48V, with baseplate, longitudinal airflow at sea level)

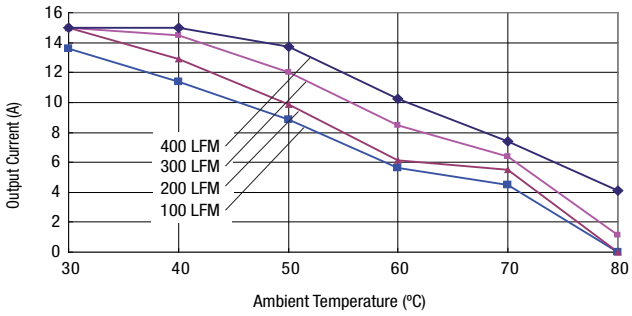


Typical Performance Curves

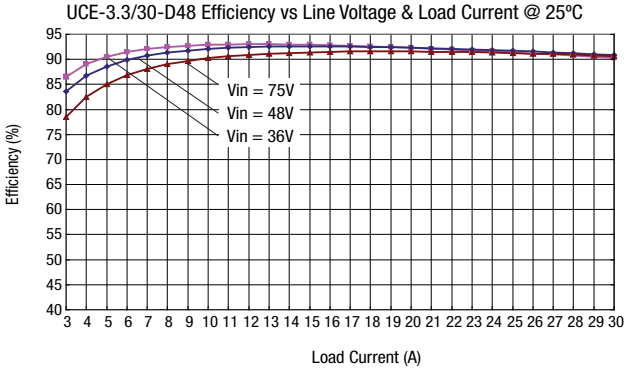
UCE-3.3/15-D48 Efficiency Vs. Line Voltage & Load Current @ +25ºC



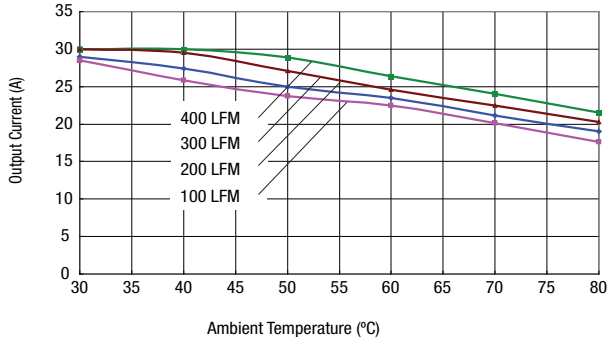
UCE-3.3/15-D48 Maximum Current Temperature Derating
(Vin = 48V, no baseplate, longitudinal airflow at sea level)



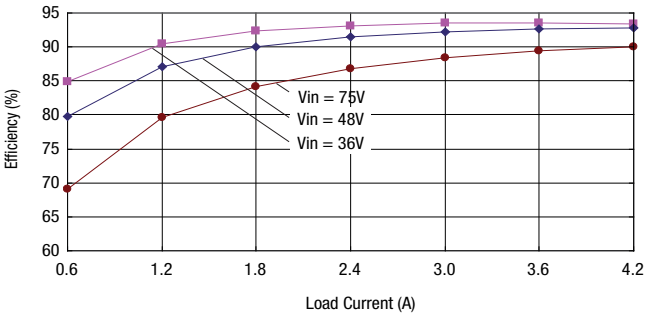
UCE-3.3/30-D48 Efficiency vs Line Voltage & Load Current @ 25ºC



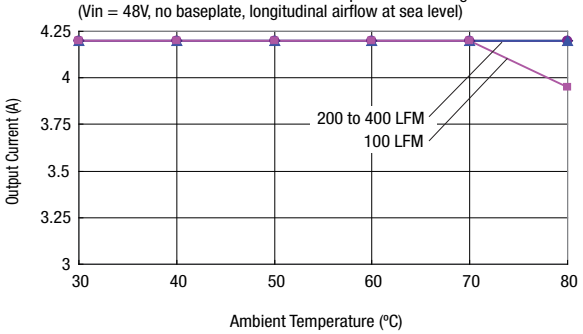
UCE-3.3/30-D48 Maximum Current Temperature Derating
(Vin = 48V, no baseplate, longitudinal airflow at sea level)



UCE-12/4.2-D48 Efficiency Vs. Line Voltage & Load Current @ +25ºC

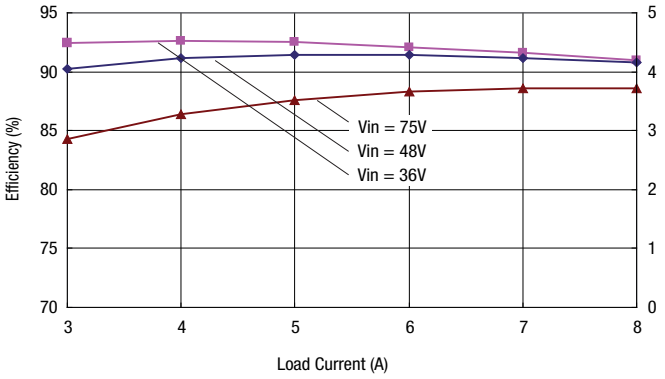


UCE-12/4.2-D48 Maximum Current Temperature Derating
(Vin = 48V, no baseplate, longitudinal airflow at sea level)

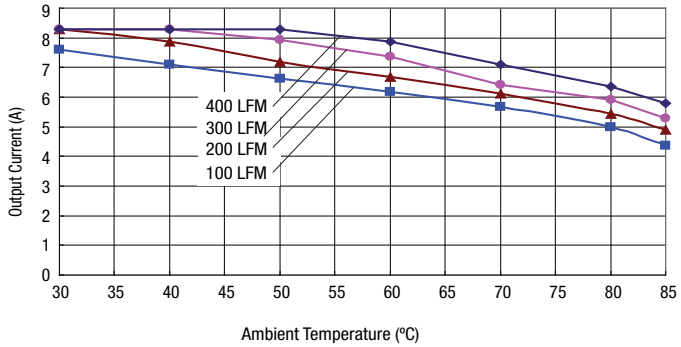


Typical Performance Curves

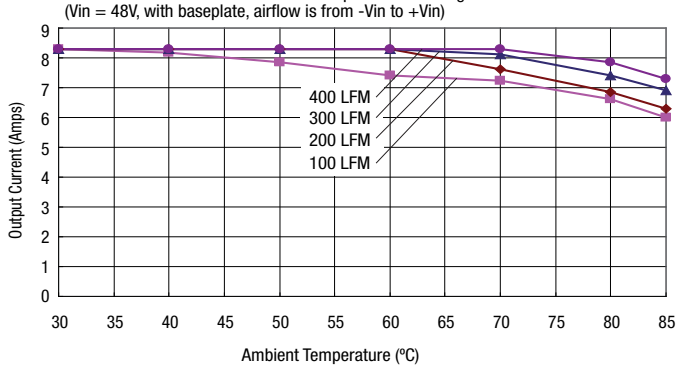
UCE-12/8.3-D48 Efficiency vs Line Voltage & Load Current @ 25ºC



UCE-12/8.3-D48 Maximum Current Temperature Derating
(Vin = 48V, no baseplate, longitudinal airflow at sea level)



UCE-12/8.3-D48 Maximum Current Temperature Derating at sea level
(Vin = 48V, with baseplate, airflow is from -Vin to +Vin)



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