



OBSOLETE PRODUCT

Typical unit

FEATURES

- 16.8 to 137.5 VDC wide input voltage range
- Fixed 5.1, 12 or 24VDC unipolar output up to 120 Watts
- 3U x 4TE x 165.5mm (111 x 20.3 x 165.5 mm) cassette module for 19-inch rack mounting
- Ruggedized "no fans" high reliability enclosure with conformal coated components
- Extensive self-protection, over temperature and short circuit features
- On/Off control, sense, current share, output OK LED, UV lockout, Hold-up Cap and trim (some functions optional)
- Adjustable input undervoltage (UVLO) protection, optional
- 2250VDC/1500VAC I/O isolation plus RoHS-6 compliance
- Operating temperature range -40 to +85° Celsius
- Extensive EU transportation and railway standards adherence

PRODUCT OVERVIEW

Housed in a 3U x 4TE x 165.5 mm extruded aluminum cassette module suitable for 19-inch rack mounting, the UCR series of isolated 100 Watt DC-DC converters provide clean DC output power over a very wide input voltage range. The standard input range is 16.8 to 137.5 Volts DC with transient capability between 14.4V and 154V. The reverse-polarity protected input is immune to surges and transients per EN50155, IEC60571 and RIA12 standards. The double reinforced insulation system protects over the full power and temperature range in compliance with IEC/EN/UL60950-1 and EN50116. The UCR series is ideal for battery and mobile distributed power applications in transportation, industrial, vehicles, signal systems, communications and railways.

The fixed output voltage is fully regulated with excellent noise, ripple and transient settling characteristics. Isolation characteristics are 2250 Volts DC (1500 VAC) input to output and input to case.

The ruggedized 3U housing features conformal coating of internal components for moisture resistance. The high efficiency design requires no forced cooling since all internal power dissipation is routed to integral extruded aluminum chassis rails. The enclosure may also be mounted against a cold plate inside a sealed chassis in conduction cooling applications. The UCR series is designed to comply with numerous environmental, EMC/EMI and safety standards (see specifications). Protection systems include output overcurrent and short circuit, over temperature shutdown (with automatic recovery) and output overvoltage. An industry-standard DIN H15 rear connector is used.

All models are equipped with an On/Off control, sense inputs, and output voltage trim ($\pm 10\%$). Optional features include output OK LED lamp and control signal, active current sharing with other UCR's, external capacitor for extended hold-up time, and adjustable input undervoltage lockout.

Murata Power Solutions recommends an external fuse, F1. See page 17 for details.

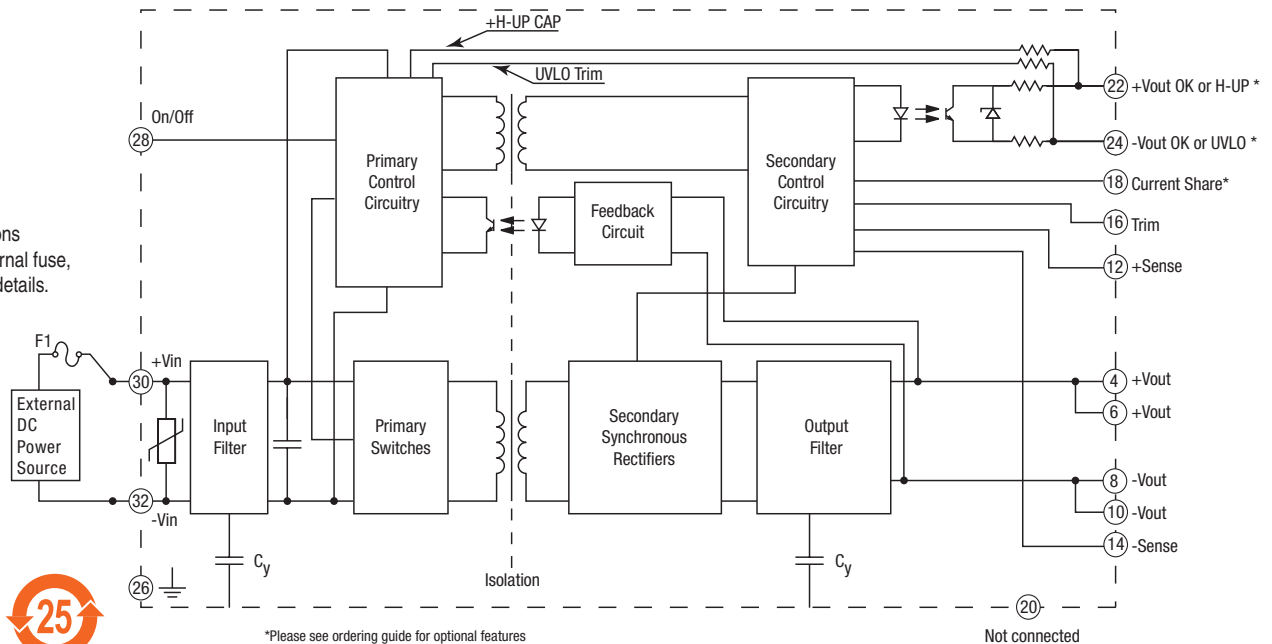


Figure 1. UCR Block Diagram



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

PERFORMANCE SPECIFICATIONS SUMMARY AND ORDERING GUIDE

Root Model Number ①	Output							Input				Efficiency		Dimensions	
	Vout (Volts DC)	Iout (Amps,max.)	Power (Watts)	R/N (mV p-p)		Regulation (max.)		Vin nom. (Volts DC)	Range (Volts) ③	Pwr, no load (W)	Iin, full load (Amps) ②				
				Typ.	Max.	Line	Load								
UCR100-050-T72-C	5.1	20	100	20	80	±0.25%	±0.25%	72	16.8-137.5	3	1.61	85.0%	87%	4.38x0.81x6.52	111x20.3x165.5
UCR100-120-T72-C	12	10	120	50	75	±0.25%	±0.25%	72	16.8-137.5	3.5	1.99	84.5%	86.5%	4.38x0.81x6.52	111x20.3x165.5
UCR100-240-T72-C	24	5.5	132	100	150	±0.25%	±0.25%	72	16.8-137.5	3.5	2.11	88%	90%	4.38x0.81x6.52	111x20.3x165.5

① These are not complete model numbers. Please refer to the Part Number Structure for ordering information of all options.

③ This is the standard input range. The transient input range (0.1 seconds) is 14.4V to 154V.

② Measured at nominal line voltage and max load, +25°C ambient temperature, sense lines connected.

PART NUMBER STRUCTURE

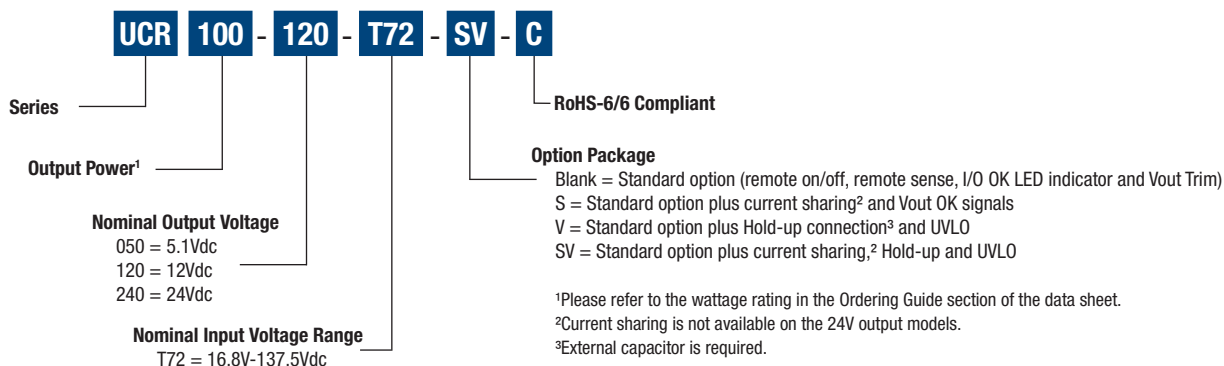


TABLE 1. OPTIONS

PART NUMBER	CURRENT SHARE	UVLO	HOLD-UP	Vout OK
UCR100-050-T72-C				
UCR100-050-T72-S-C	✓			✓
UCR100-050-T72-SV-C	✓	✓	✓	
UCR100-050-T72-V-C		✓	✓	
UCR100-120-T72-C				
UCR100-120-T72-S-C	✓			✓
UCR100-120-T72-SV-C	✓	✓	✓	
UCR100-120-T72-V-C		✓	✓	
UCR100-240-T72-C				
UCR100-240-T72-V-C		✓	✓	

FUNCTIONAL SPECIFICATIONS, UCR100-050-T72 ①

INPUT	Conditions/Comments	Minimum	Typical/Nominal	Maximum	Units
Operating voltage range, standard		16.8	72	137.5	Vdc
Surge and Transient Protection	Per EN50155, IEC60571 and RIA12				
Input Limits, no damage	Operating or non-operating	0		154	Vdc
Input Filter	Per EN50155, Symmetrical combined with VDR/transorb				
Reverse Polarity Protection	Yes, in conjunction with external fuse.				Vdc
Start-up threshold		12.8	14.6	16.4	Vdc
Undervoltage shutdown ②	50% load	10.5	12.3	14.0	Vdc
Overvoltage shutdown	50% load		170		Vdc
Input current/power					
Full Load Current			1.30	1.67	Amps
Peak Inrush Current			40		Amps
Short Circuit Input Current			0.05	0.1	Amps
No Load Input Power	I _{out} = minimum		3.0	3.5	Watts
Low Line Input Current	V _{in} = minimum		5.89	7.57	Amps
Shutdown Mode Input Current			5	10	mA
Reflected (back) ripple current ③			5	10	mA pk-pk
GENERAL and SAFETY					
Efficiency	V _{in} = nom., 16A load	85	87		%
	V _{in} = 110V, 16A load	85	86.5		%
	V _{in} = 24V, 16A load	81	82.5		%
Switching Frequency		90	100	110	KHz
Turn-On Time	V _{in} on to V _{out} regulated		150	160	mS
	Remote ON to V _{out} regulated		150	160	mS
Isolation Voltage	Input to output, case and aux. test	2250			Vdc
Isolation Voltage	Case to output and Aux. test voltage	2250			Vdc
Subassemblies pre-tested per EN50116/60950		4200			Vdc
Isolation Safety Rating	Based on 250 VAC or 240 VDC I/O		Double/Reinforced		
Isolation Resistance		100			Mohm
Isolation Capacitance			4000		pF
Safety (Designed to meet the following requirements)	UL-60950-1, (2nd Edition), CSA-C22.2 No.60950-1, IEC/EN60950-1		Yes		
Calculated MTBF	per MIL-HDBK-217F				
	Ground benign, T _{case} = 40°C		TBC		Hours
	Ground benign, T _{case} = 40/70°C		TBC		Hours
	Ground benign, T _{case} = 50°C		TBC		Hours
OUTPUT					
Total Output Power	Full temperature range	0.0	81.6	103.02	Watts
Voltage					
Output Voltage Range	V _{out} = nominal	5.049	5.1	5.151	Vdc
Setting Accuracy	50% load		±1		% of V _{nom} .
Overvoltage Protection	magnetic feedback	5.9	6.2	6.5	Vdc
V _{out} Adjustment Range <optional>		-10		10	% of V _{nom} .
Current					
Output Current Range	V _{in} = 16.8-137.5V.	0.0	16	20	Amps
Current Limit Inception	98% of V _{nom} ., after warmup	24	26.35	28.70	Amps
Short Circuit Current	Hiccup technique, autorecovery within ±1% of V _{out}		0.5	1	Amps
Short Circuit Duration	Output shorted to ground		Continuous		
Short circuit protection method	Current limiting, hiccup autorestart				
Line Regulation	V _{in} = min. to max.			±0.25	% of V _{nom} .
	V _{out} = nom.				
Load Regulation	I _{out} = min. to max.			±0.25	% of V _{nom} .
Dynamic Load Response	50-75-50% load step		75	150	µSec
	settling time to within ±1% of V _{out}				
	Peak deviation		±200	±250	mV
Ripple and Noise, 1 & 10 µF output	5 Hz- 20 MHz BW		20	80	mV pk-pk
Temperature Coefficient	At all outputs		±0.02		% of V _{nom} /°C
Maximum Output Capacitance	ESR 0.02Ω min., resistive load			6600	µF

Notes

① Unless otherwise noted, units are specified with 1µF ceramic and 10µF tantalum external output capacitors in parallel (low ESR). The external input capacitor is 33µF, low ESR.

② Undervoltage shutdown is also available as a user-adjustable option.

③ Back ripple current input filter is C_{in}=33µF, C_{bus}=220µF, L_{bus}=12µH

④ Remove overload for recovery

⑤ Output may be shorted to ground with no damage.

FUNCTIONAL SPECIFICATIONS, UCR100-120-T72 ①

INPUT	Conditions/Comments	Minimum	Typical/Nominal	Maximum	Units
Operating voltage range, standard		16.8	72	137.5	Vdc
Surge and Transient Protection	Per EN50155, IEC60571 and RIA12				
Input Limits, no damage	Operating or non-operating	0		154	Vdc
Input Filter	Per EN50155, Symmetrical combined with VDR/transorb				
Reverse Polarity Protection	Yes, in conjunction with external fuse				Vdc
Start-up threshold		11.5	15.0	16.3	Vdc
Undervoltage shutdown ②	50% load	10.3	12	14.8	Vdc
Overvoltage shutdown	50% load		170		Vdc
Input current/power					
Full Load Current			1.54	1.99	Amps
Peak Inrush Current			40		Amps
Short Circuit Input Current			0.05	0.1	Amps
No Load Input Power	Iout = minimum		3.5	4.5	Watts
Low Line Input Current	Vin = minimum		7.05	9.37	Amps
Shutdown Mode Input Current			5	10	mA
Reflected (back) ripple current ③			5	10	mA pk-pk
GENERAL and SAFETY					
Efficiency	Vin = nom., 8A load	84.5	86.5		%
	Vin = 110V, 8A load	86	87.5		%
	Vin = 24V, 8A load	77	81		%
Switching Frequency		90	100	110	KHz
Turn-On Time	Vin on to Vout regulated		150	160	mS
	Remote ON to Vout regulated		150	160	mS
Isolation Voltage	Input to output, case and aux. test	2250			Vdc
Isolation Voltage	Case to output and Aux. test voltage	2250			Vdc
Subassemblies pre-tested per EN50116/60950		4200			Vdc
Isolation Safety Rating	Based on 250 VAC or 240 VDC I/O		Double/Reinforced		
Isolation Resistance		100			Mohm
Isolation Capacitance			4000		pF
Safety (Designed to meet the following requirements)	UL-60950-1, (2nd Edition), CSA-C22.2 No.60950-1, IEC/EN60950-1		Yes		
Calculated MTBF	per MIL-HDBK-217F				
	Ground benign, Tcase = 40°C		TBC		Hours
	Ground benign, Tcase = 40/70°C		TBC		Hours
	Ground benign, Tcase = 50°C		TBC		Hours
OUTPUT					
Total Output Power	Full temperature range	0.0	96	121.2	Watts
Voltage					
Output Voltage Range	Vout = nominal	11.88	12.0	12.12	Vdc
Setting Accuracy	50% load		±1		% of Vnom.
Overvoltage Protection	magnetic feedback	13.5	14.4	15	Vdc
Vout Adjustment Range <optional>		-10		10	% of Vnom.
Current					
Output Current Range	Vin = 16.8-137.5V.	0.0	8.0	10.0	Amps
Current Limit Inception	98% of Vnom., after warmup	14	16	18	Amps
Short Circuit Current	Hiccup technique, autorecovery within ±1% of Vout		0.5	1	Amps
Short Circuit Duration	Output shorted to ground		Continuous		
Short circuit protection method	Current limiting, hiccup autorestart				
Line Regulation	Vin = min. to max.			±0.25	% of Vnom.
	Vout = nom.				
Load Regulation	Iout = min. to max.			±0.25	% of Vnom.
Dynamic Load Response	50-75-50% load step		100	200	µSec
	settling time to within ±1% of Vout				
	Peak deviation		±200	±250	mV
Ripple and Noise, 1 & 10 µF output capacitors	5 Hz- 20 MHz BW		50	75	mV pk-pk
Temperature Coefficient	At all outputs		±0.02		% of Vnom./°C
Maximum Output Capacitance	ESR 0.02Ω min., resistive load			3300	µF

Notes

① Unless otherwise noted, units are specified with 1µF ceramic and 10µF tantalum external output capacitors in parallel (low ESR). The external input capacitor is 33µF, low ESR.

② Undervoltage shutdown is also available as a user-adjustable option.

③ Back ripple current input filter is Cin=33µF, Cbus=220µF, Lbus=12µH

④ Remove overload for recovery

⑤ Output may be shorted to ground with no damage.

FUNCTIONAL SPECIFICATIONS, UCR100-240-T72 ①

INPUT	Conditions/Comments	Minimum	Typical/Nominal	Maximum	Units
Operating voltage range, standard		16.8	72	137.5	Vdc
Surge and Transient Protection	Per EN50155, IEC60571 and RIA12				
Input Limits, no damage	Operating or non-operating	0		154	Vdc
Input Filter	Per EN50155, Symmetrical combined with VDR/transorb				
Reverse Polarity Protection	Supplied standard		Yes		Vdc
Start-up threshold		11.5	13.9	16.3	Vdc
Undervoltage shutdown ②	50% load	10.5	12.7	14.8	Vdc
Overvoltage shutdown	50% load		170		Vdc
Input current/power					
Full Load Current			1.63	2.11	Amps
Peak Inrush Current			40		Amps
Short Circuit Input Current			0.25	0.35	Amps
No Load Input Power	I _{out} = minimum		3.5	4.5	Watts
Low Line Input Current	V _{in} = minimum		7.76	10.09	Amps
Shutdown Mode Input Current			5	10	mA
Reflected (back) ripple current ③			5	10	mA pk-pk
GENERAL and SAFETY					
Efficiency	V _{in} = nom., 4.4A load	88	90		%
	V _{in} = 110V, 4.4A load	86.5	88.5		%
	V _{in} = 24V, 4.4A load	79	81		%
Switching Frequency		90	100	110	KHz
Turn-On Time	V _{in} on to V _{out} regulated		150	160	mS
	Remote ON to V _{out} regulated		150	160	mS
Isolation Voltage	Input to output, case and aux. test	2250			Vdc
Isolation Voltage	Case to output and Aux. test voltage	2250			Vdc
Subassemblies pre-tested per EN50116/60950		4200			Vdc
Isolation Safety Rating	Based on 250 VAC or 240 VDC I/O		Double/Reinforced		
Isolation Resistance		100			Mohm
Isolation Capacitance			4000		pF
Safety (Designed to meet the following requirements)	UL-60950-1, (2nd Edition), CSA-C22.2 No.60950-1, IEC/EN60950-1		Yes		
Calculated MTBF	per MIL-HDBK-217F				
	Ground benign, T _{case} = 40°C		TBC		Hours
	Ground benign, T _{case} = 40/70°C		TBC		Hours
	Ground benign, T _{case} = 50°C		TBC		Hours
OUTPUT					
Total Output Power	Full temperature range	0.0	105.6	133.98	Watts
Voltage					
Output Voltage Range	V _{out} = nominal	23.64	24.0	24.36	Vdc
Setting Accuracy	50% load		±1.5		% of V _{nom} .
Overvoltage Protection	magnetic feedback	27	28.5	30	Vdc
V _{out} Adjustment Range <optional>		-10		10	% of V _{nom} .
Current					
Output Current Range	V _{in} = 16.8-137.5V.	0.0	4.4	5.5	Amps
Current Limit Inception	98% of V _{nom} ., after warmup	6.5	7.75	9.5	Amps
Short Circuit Current	Hiccup technique, autorecovery within ±1% of V _{out}		0.5	1	Amps
Short Circuit Duration	Output shorted to ground		Continuous		
Short circuit protection method	Current limiting, hiccup autorestart				
Line Regulation	V _{in} = min. to max.			±0.25	% of V _{nom} .
	V _{out} = nom.				
Load Regulation	I _{out} = min. to max.			±0.25	% of V _{nom} .
Dynamic Load Response	50-75-50% load step		100	200	µSec
	settling time to within ±1% of V _{out}				
	Peak deviation		±200	±250	mV
Ripple and Noise, 1 & 10 µF output	5 Hz- 20 MHz BW		100	150	mV pk-pk
Temperature Coefficient	At all outputs		±0.02		% of V _{nom} /°C
Maximum Output Capacitance	ESR 0.02Ω min., resistive load			1200	µF

Notes

① Unless otherwise noted, units are specified with 1µF ceramic and 10µF tantalum external output capacitors in parallel (low ESR). The external input capacitor is 33µF, low ESR.

② Undervoltage shutdown is also available as a user-adjustable option.

③ Back ripple current input filter is C_{in}=33µF, C_{bus}=220µF, L_{bus}=12µH

④ Remove overload for recovery

⑤ Output may be shorted to ground with no damage.

FUNCTIONAL SPECIFICATIONS FOR ALL MODELS, CONTINUED

FEATURES and OPTIONS	Conditions/Comments	Minimum	Typical/Nominal	Maximum	Units
Remote On/Off Control	Negative logic				
Unit is OFF	Pin open or external voltage	2.5		50	Vdc
Unit is ON		-0.5		0.8	Vdc
Shutdown Current	Open collector/drain		1	2	mA
Remote Sense	Sense pins connected externally to respective Vout's			10	%
Vout trim		-10		+10	% of Vout
Pre-biased startup	External voltage < Vset		Monotonic		
Isolated Vout "OK" Signal <optional> ("S" suffix)					
Vout ready (LO)	Iok < 0.5 mA		0.8	1.0	Vdc
Vout fail (HI)	External Vok < 15V.			25	μA
Current Share <optional>	"S" or "SV" suffix		±20		% of Iout
External Cap Hold-up Time <"V" or "SV" suffix>	See Hold-up Time note	10			mS
Input Undervoltage Lockout <"V" or "SV" suffix>	See Input Undervoltage Lockout note				
MECHANICAL					
Outline Dimensions			4.38x0.81x6.52		Inches
please refer to Mechanical Specifications			111x20.3x165.5		mm
Weight: UCR100-050-T72, UCR100-120-T72			18		Ounces
			510		Grams
Weight: UCR100-240-T72			21		Ounces
			595		Grams
Case Material			Aluminum		
Rear Connector	P87 pinout, per DIN41612		H15		
EMI/RFI Shielding			Provided by case		
ENVIRONMENTAL					
Operating Ambient Temperature Range	See Performance Data for temperature derating curves	-40		71	°C
Absolute Operating Temperature Range	With derating	-40		95	°C
Storage Temperature	Vin = Zero (no power)	-55		125	°C
Thermal Protection/Shutdown	Measured at case center	105	110	120	°C
Electromagnetic Interference (pending)					
Conducted, EN55022/CISPR22	Measure within 19" rack				
Radiated, EN55022/CISPR22					
Relative humidity, non-condensing			To +85°C/85%		
ABSOLUTE MAXIMUM RATINGS					
Input Voltage, Transient	Operating or non-operating, 100 mS max.	0		154	Vdc
Input Reverse Polarity			Yes		Vdc
On/Off Control	Power on or off, referred to -Vin	-0.5		50	Vdc
Storage Temperature Range	Vin = Zero (no power)	-55		125	°C

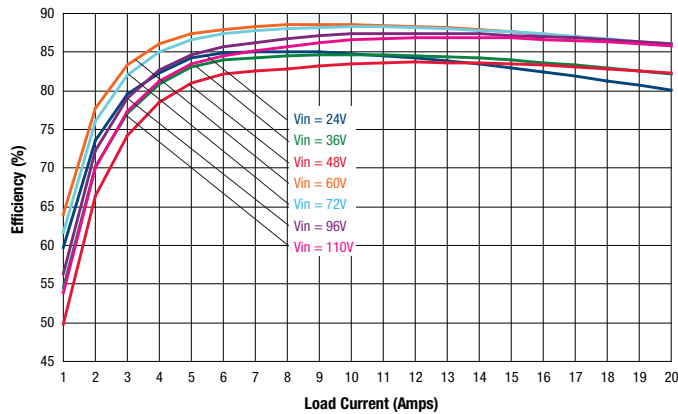
Notes

- ① Unless otherwise noted, units are specified with 1μF ceramic and 10μF tantalum external output capacitors in parallel (low ESR). The external input capacitor is 33μF, low ESR.
- ② Undervoltage shutdown is also available as a user-adjustable option.

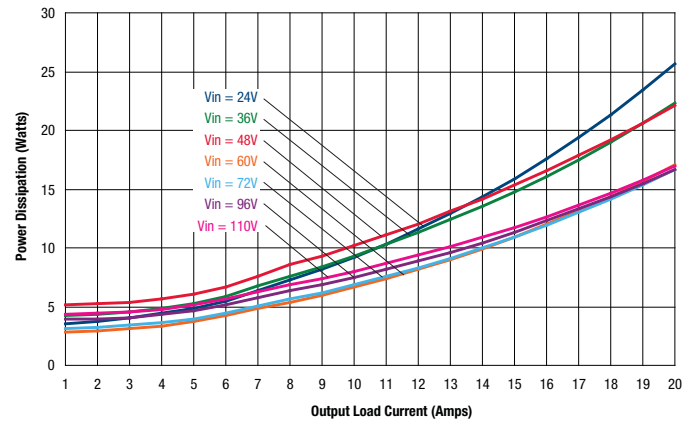
- ③ Back ripple current input filter is Cin=33μF, Cbus=220μF, Lbus=12μH
- ④ Remove overload for recovery
- ⑤ Output may be shorted to ground with no damage.

PERFORMANCE DATA, UCR100-050-T72-C

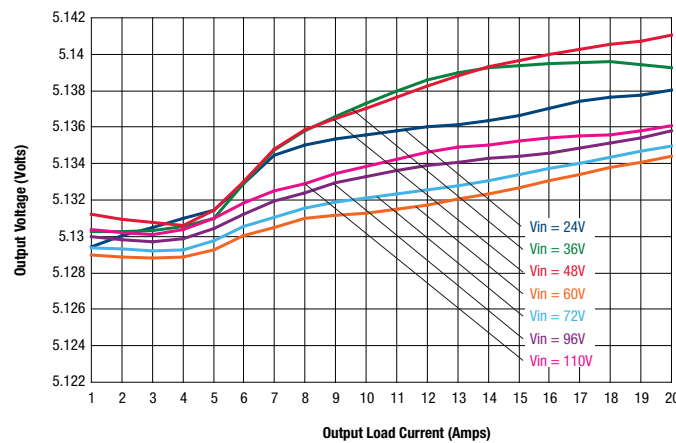
Efficiency vs. Line Voltage and Load Current @ Ta = +25°C



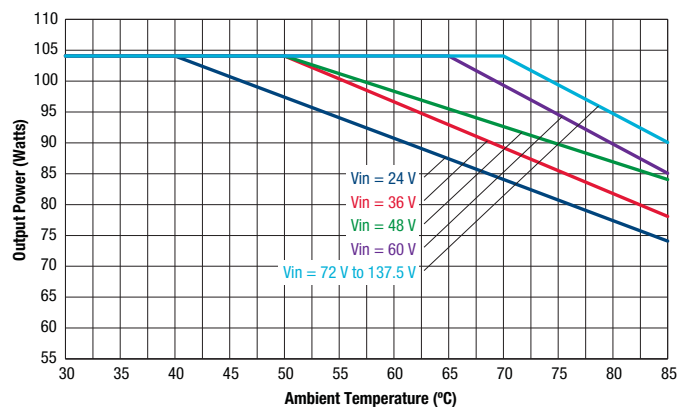
Power Dissipation vs. Load Current @ Ta = +25°C



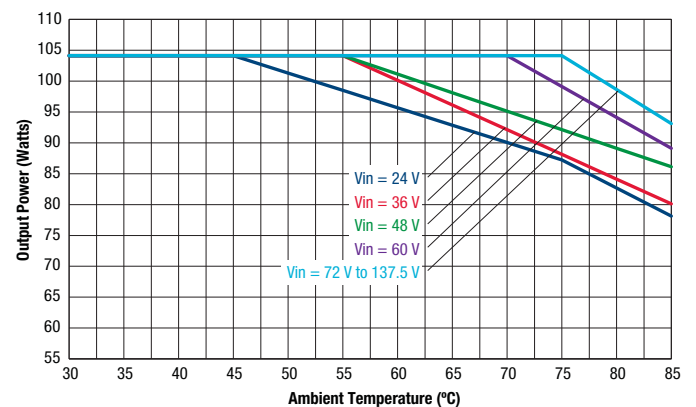
Output Voltage Vs. Input Line Voltage and Output Load Current



Maximum Power Temperature Derating at Sea Level
Natural Convection

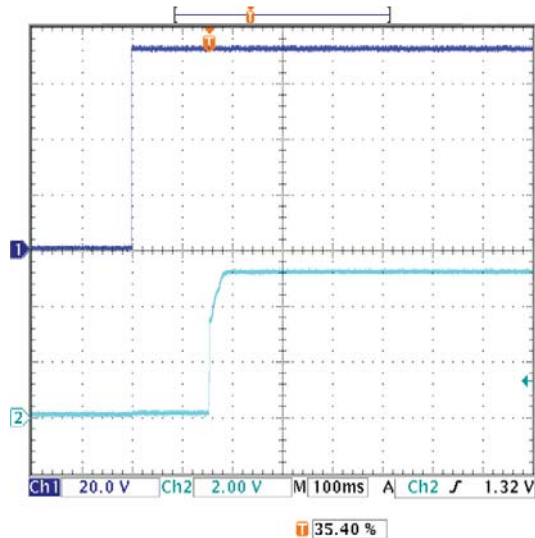


Maximum Power Temperature Derating at Sea Level
100 LFM (air flow from Rear Panel to Input Conn.)

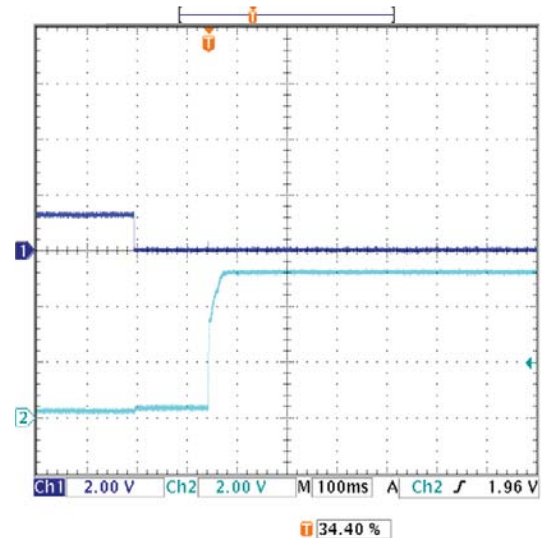


PERFORMANCE DATA, UCR100-050-T72-C

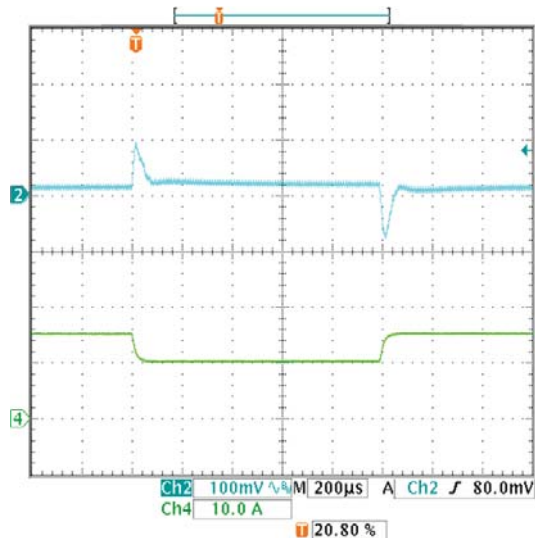
Start-up Delay (Vin=72V, Vout=nom, Iout=20A, Cload=8000uF, Ta=+25°C)
Trace1=Vin, Trace 2=Vout.



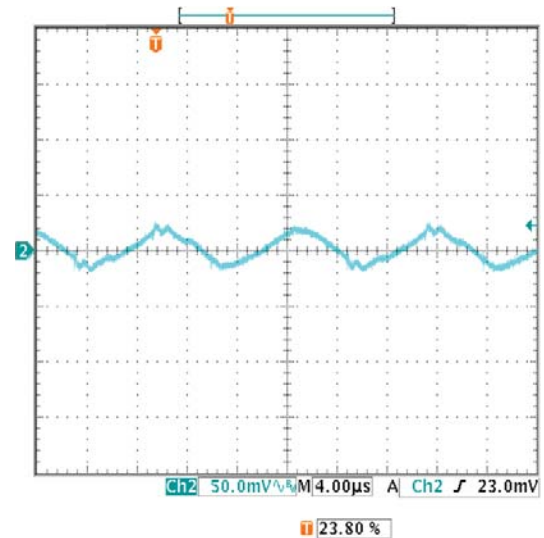
On/Off Enable Start-up (Vin=72V, Vout=nom, Iout=20A, Cload=8000uF, Ta=+25°C) Trace1=Vin, Trace 2=Vout.



Step Load Transient Response (Vin=72V, Vout=nom, Cload= 10uF || 1uF, Iout=50-75-50% of full load (Iout=10A/Div), Ta=+25°C)

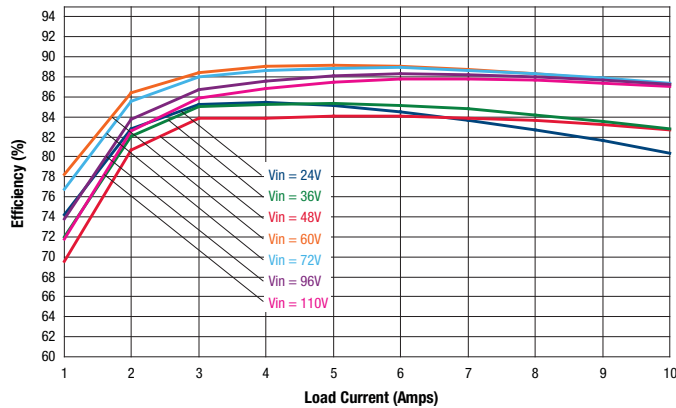


Output Ripple and Noise (Vin=72V, Iout=20A, Cload= 10uF || 1uF, Ta=+25°C)

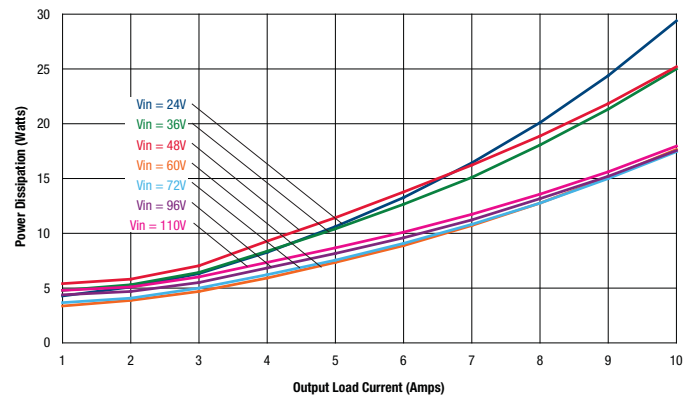


PERFORMANCE DATA, UCR100-120-T72-C

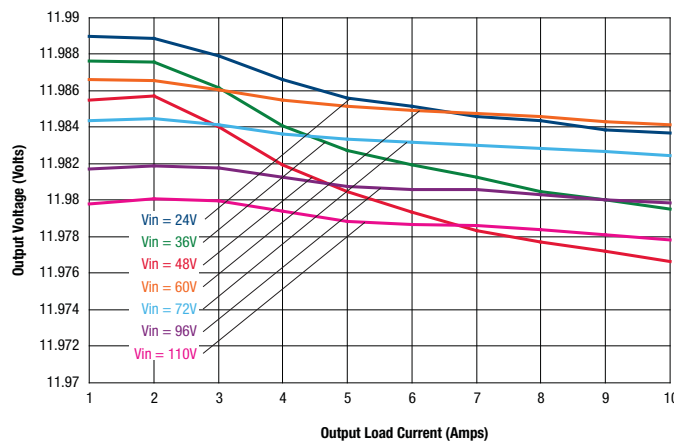
Efficiency vs. Line Voltage and Load Current @ Ta = +25°C



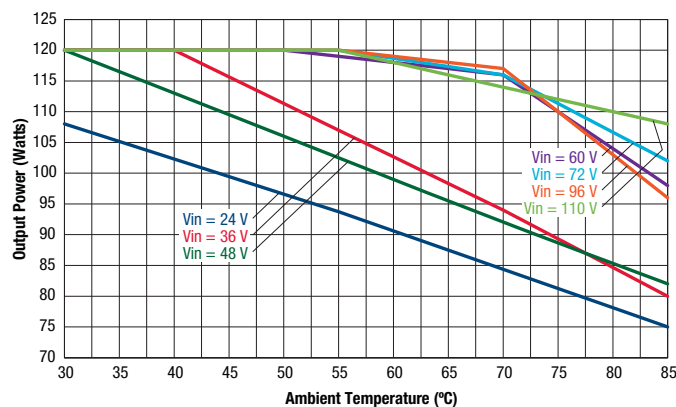
Power Dissipation vs. Load Current @ Ta = +25°C



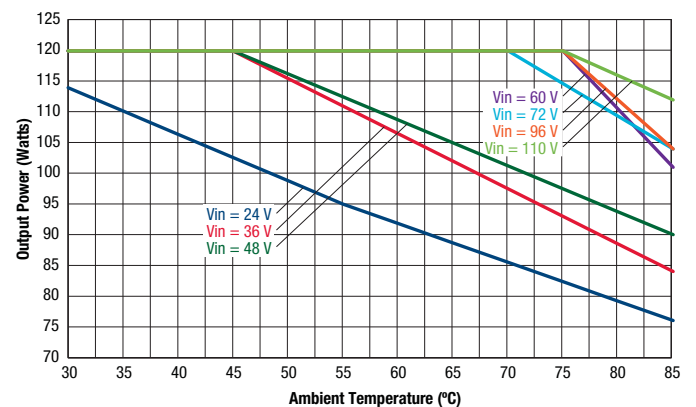
Output Voltage vs. Input Line Voltage and Output Load Current



Maximum Power Temperature Derating at Sea Level
Natural Convection

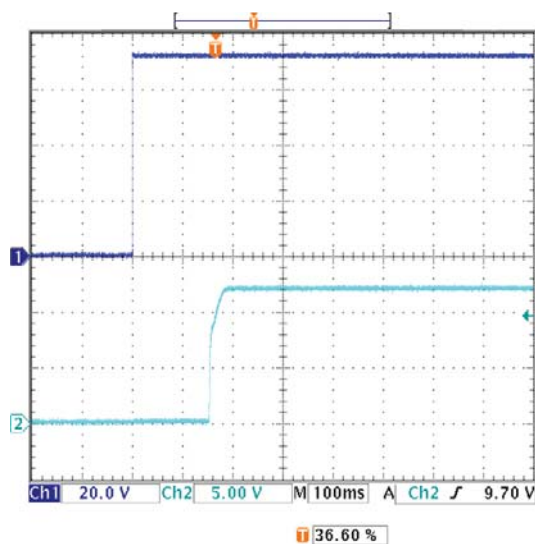


Maximum Power Temperature Derating at Sea Level
100 LFM (air flow from Rear Panel to Input Conn.)

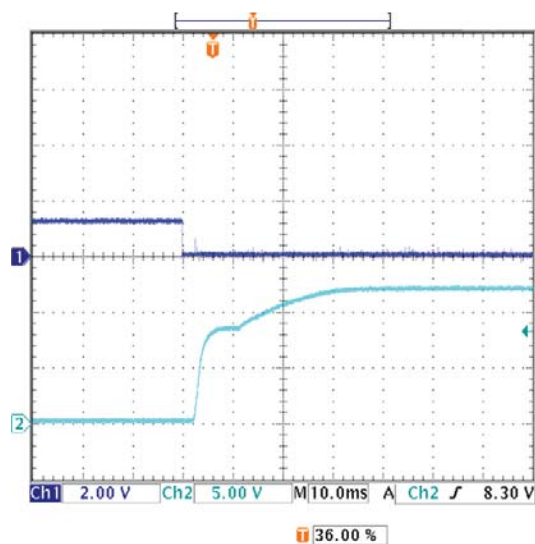


PERFORMANCE DATA, UCR100-120-T72-C

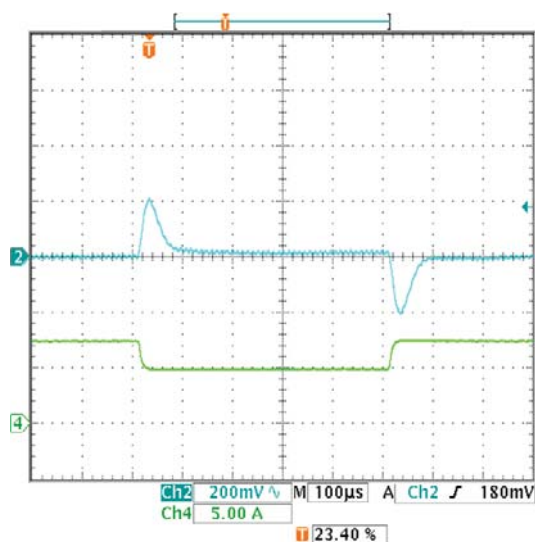
Start-up Delay (Vin=72V, Vout=nom, Iout=10A, Cload=4700uF, Ta=+25°C)
Trace1=Vin, Trace 2=Vout.



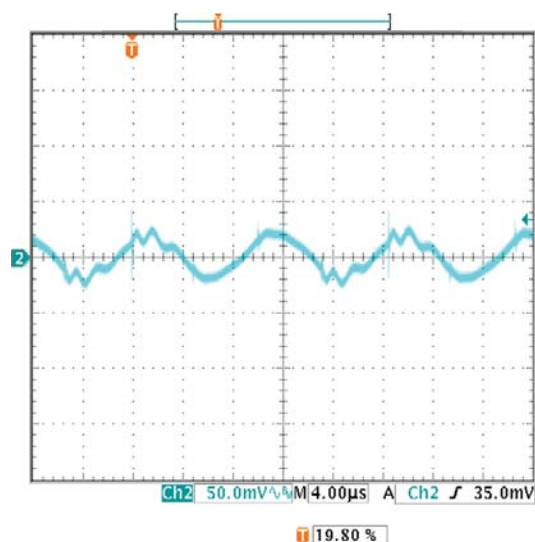
On/Off Enable Start-up (Vin=72V, Vout=nom, Iout=10A, Cload=3300uF, Ta=+25°C) Trace1=Vin, Trace 2=Vout.



Step Load Transient Response (Vin=72V, Vout=nom, Cload= 10uF || 1uF, Iout=50-75-50% of full load (Iout=5A/Div), Ta=+25°C)

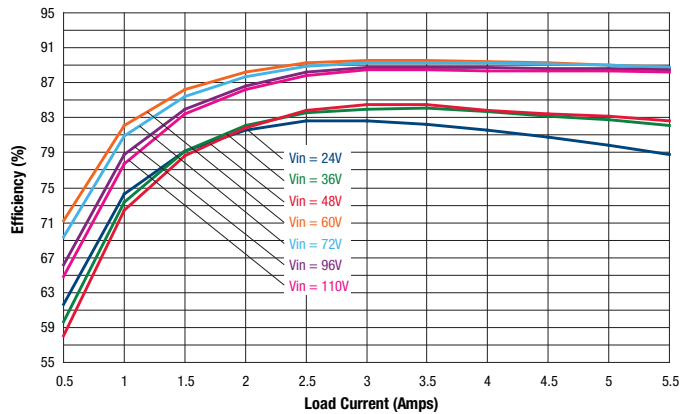


Output Ripple and Noise (Vin=72V, Iout=10A, Cload= 10uF || 1uF, Ta=+25°C)

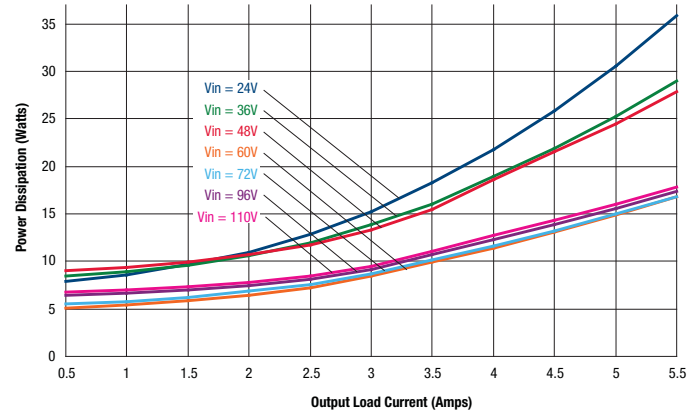


PERFORMANCE DATA, UCR100-240-T72-C

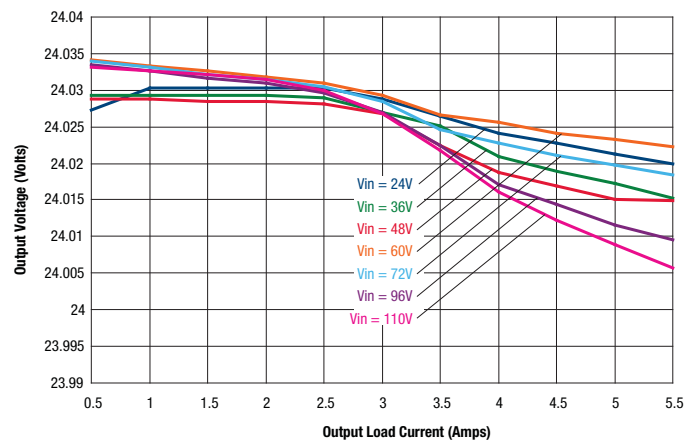
Efficiency vs. Line Voltage and Load Current @ Ta = +25°C



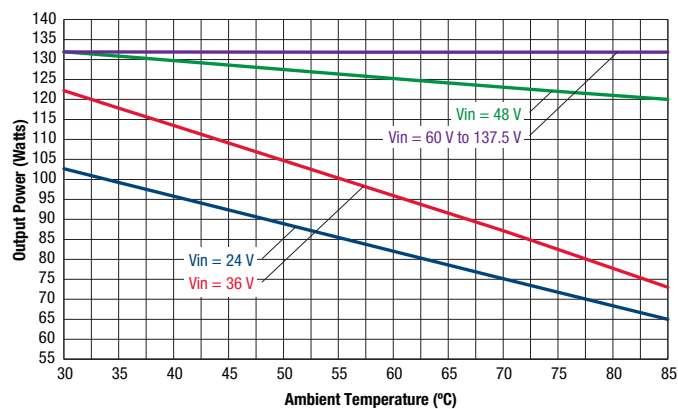
Power Dissipation vs. Load Current @ Ta = +25°C



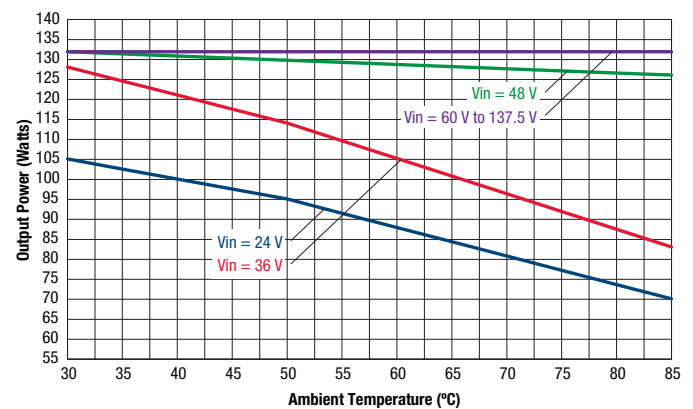
Output Voltage Vs. Input Line Voltage and Output Load Current



Maximum Power Temperature Derating at Sea Level
Natural Convection

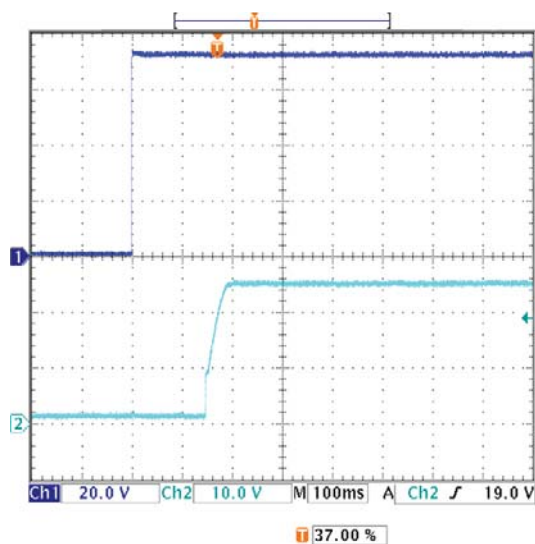


Maximum Power Temperature Derating at Sea Level
100 LFM (air flow from Rear Panel to Input Conn.)

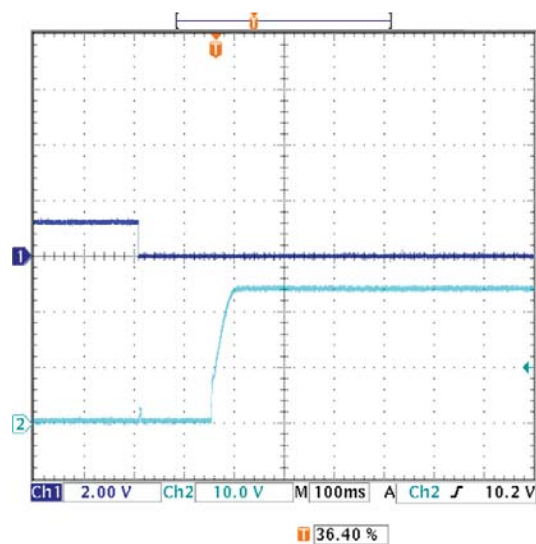


PERFORMANCE DATA, UCR100-240-T72-C

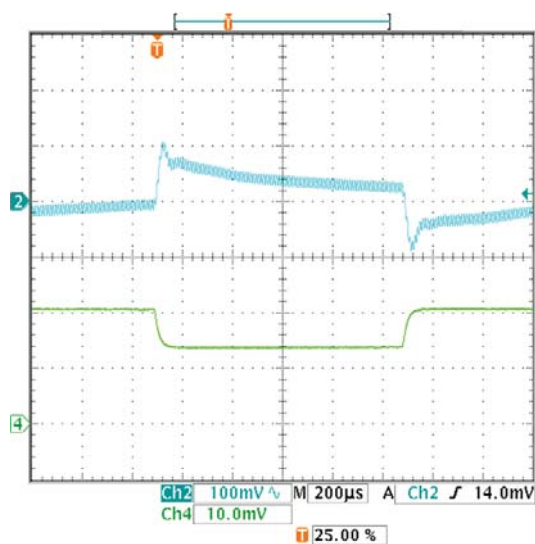
Start-up Delay (Vin=72V, Vout=nom, Iout=5.5A, Cload=1200uF, Ta=+25°C)
Trace1=Vin, Trace 2=Vout.



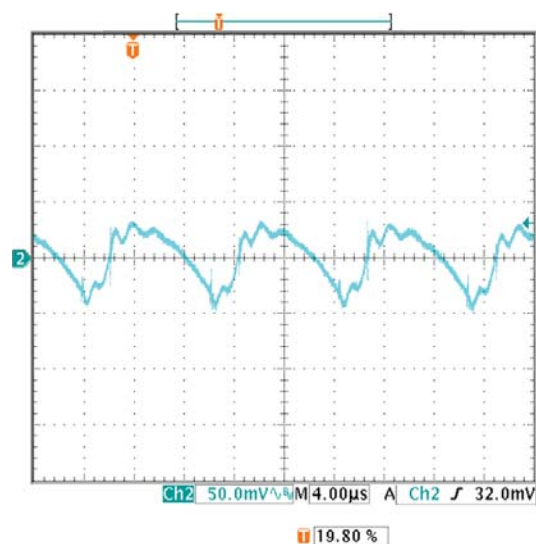
On/Off Enable Start-up (Vin=72V, Vout=nom, Iout=5.5A, Cload=1200uF, Ta=+25°C) Trace1=Vin, Trace 2=Vout.



Step Load Transient Response (Vin=72V, Vout=nom, Cload= 10uF || 1uF, Iout=50-75-50% of full load (Iout=2A/Div), Ta=+25°C)

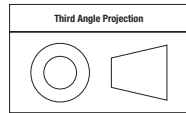


Output Ripple and Noise (Vin=72V, Iout=5.5A, Cload= 10uF || 1uF, Ta=+25°C)



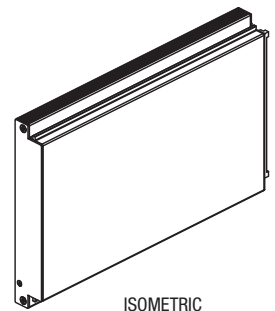
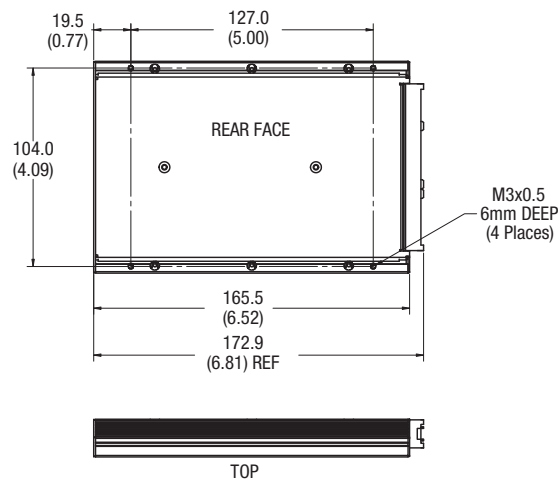
MECHANICAL SPECIFICATIONS

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



Tolerances (unless otherwise specified):
 .XX ± 0.02 (0.5)
 .XXX ± 0.010 (0.25)
 Angles ± 1°

Components are shown for reference only.



4 TE Module Slot
(REF ONLY)

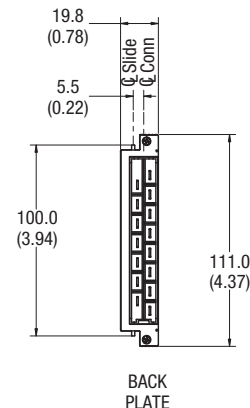
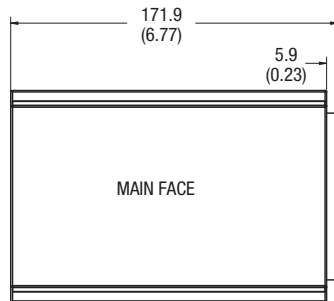
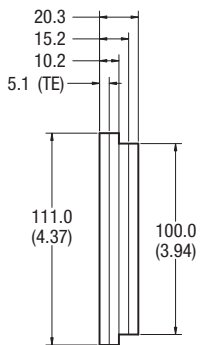


Figure 2. Case C90

TABLE 2. PIN ALLOCATION

Pin	Function	Standard	Option "S"	Option "V"	Option "SV"
4	Output Voltage (positive)	+Vout	+Vout	+Vout	+Vout
6	Output Voltage (positive)	+Vout	+Vout	+Vout	+Vout
8	Output Voltage (negative)	-Vout	-Vout	-Vout	-Vout
10	Output Voltage (negative)	-Vout	-Vout	-Vout	-Vout
12	Remote Sense (positive)*	+Sense	+Sense	+Sense	+Sense
14	Remote Sense (negative)*	-Sense	-Sense	-Sense	-Sense
16	Output Voltage Trim	Trim	Trim	Trim	Trim
18	Current Share	NA***	Current Share	NA***	Current Share
20	Not Connected	NC	NC	NC	NC
22	+ Vout OK / Hold-up	NC	+Vout OK	H-UP	H-UP
24	- Vout OK / UVLO	NC	-Vout OK	UVLO	UVLO
26	Protective Earth*	PE	PE	PE	PE
28	Remote On/Off**	On/Off	On/Off	On/Off	On/Off
30	Input Voltage (positive)	+Vin	+Vin	+Vin	+Vin
32	Input Voltage (negative)	-Vin	-Vin	-Vin	-Vin

* Leading pin (connect first, break last)

** Connect to -Vin if not used

*** Pin is disconnected internally

Pinout P87

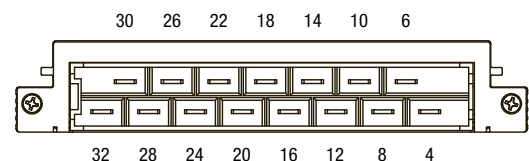
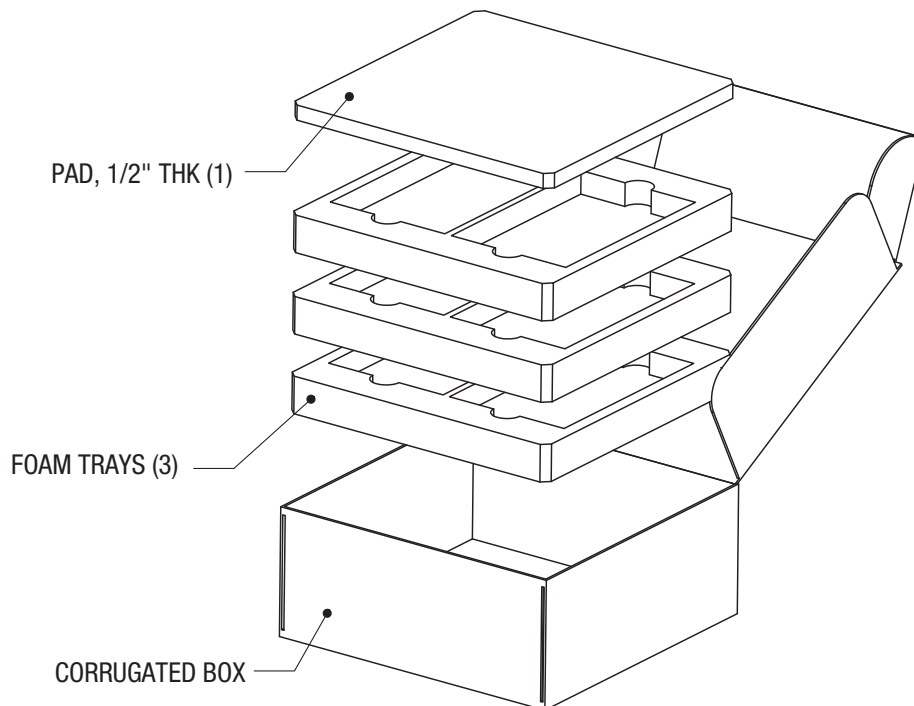


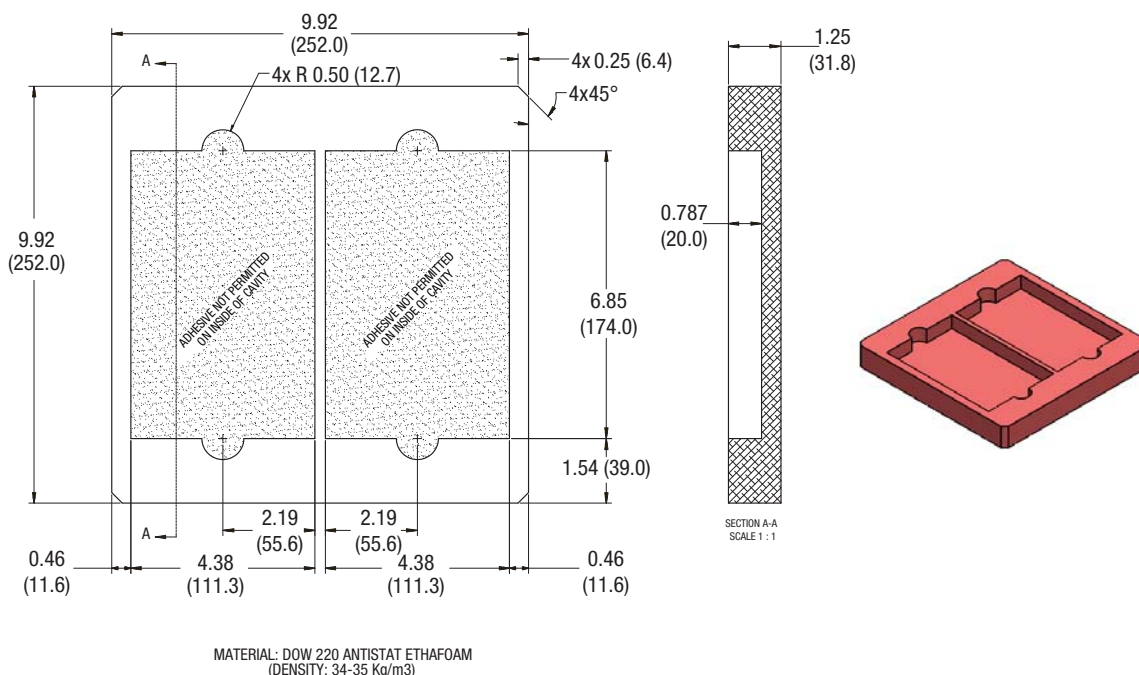
Figure 3. Rear connector detail

When using units with the load share option in stand-alone operation with the remote sense feature, the load share pin must be connected to -Vout. This does not apply if the remote sense lines are connected directly at the connector.

SHIPPING TRAYS AND BOXES (3 TRAYS PER CARTON, 6 UNITS PER CARTON)



SHIPPING TRAY DIMENSIONS (2 UNITS PER TRAY)



Electromagnetic Compatibility (EMC) Immunity:

A transorb diode together with a symmetrical input filter form an effective protection against high input transient voltages, which typically occur in most installations, but especially in battery-driven mobile applications. The UCR-Series are tested to the following specifications:

Phenomenon	Standard	Level	Coupling mode ①	Value applied	Waveform	Source impedance	Test procedure	In operation	Perf. crit. ②
Supply related surge	RIA 12	B	+i/− i	1.5 x V _{batt}	0.1/1/0.1 s	0.2 Ω	1 positive surge	yes	A
	EN 50155			1.4 x V _{batt}		1 Ω			
Direct transients	RIA 12 EN 50155: 1995	D ④	−i/c, +i/−i	1800 V _p	5/50 μs	5 Ω	5 pos. and 5 neg. impulses	yes	A
		G ⑤		8400 V _p	0.05/0.1 μs	100 Ω			
Indirect coupled transients		H	1800 V _p	5/50 μs					
		L	8400 V _p	0.05/0.1 μs					
Electrostatic discharge (to case)	IEC/EN 61000-4-2	4 ⑥	contact discharge	8000 V _p	1/50 ns	330 Ω	10 positive and 10 negative discharges	yes	B
			air discharge	15000 V _p					
Electromagnetic field	IEC/EN 61000-4-3	x ⑦	antenna	20 V/m	AM 80% 1 kHz	n.a.	80 – 1000 MHz	yes	A
	ENV 50204	4 ⑩	antenna	30 V/m	50% duty cycle, 200 Hz repetition frequency	n.a.	900 ±5 MHz	yes	A
Electrical fast transients/burst	IEC/EN 61000-4-4	4 ⑧	capacitive, o/c	2000 V _p	bursts of 5/50 ns 5 kHz over 15 ms; burst period: 300 ms	50 Ω	60 s positive 60 s negative transients per coupling mode	yes	B
			direct, +i/c, −i/c, +i/−i	4000 V _p					
Surges	IEC/EN 61000-4-5	3 ③	i/c	2000 V _p ③	1.2/50 μs	12 Ω	5 pos. and 5 neg. surges per coupling mode	yes	B
		2 ③	+i/−i	1000 V _p ③		2 Ω			
Conducted disturbances	IEC/EN 61000-4-6	3 ⑨	i, o, signal wires	10 VAC (140 dBμV)	AM 80% 1 kHz	150 Ω	0.15 – 80 MHz	yes	A

① i = input, o = output, c = case.

② A = Normal operation, no deviation from specs, B = Temporary deviation from specs possible.

③ Measured with an external input capacitor specified in table 4 of the standard.

④ Corresponds to EN 50155:2001, waveform A, and EN 50121-3-2:2000, table 7.2.

⑤ Corresponds to EN 50155:2001, waveform B.

⑥ Corresponds to EN 50121-3-2:2000, table 9.2.

⑦ Corresponds to EN 50121-3-2:2000, table 9.1.

⑧ Corresponds to EN 50121-3-2:2000, table 7.1.

⑨ Corresponds to EN 50121-3-2:2000, table 7.4.

⑩ Fulfills also EN 50121-5:2000, table 1.2, where ENV 50204 is referenced.

Immunity to Environmental Conditions

Test method		Standard	Test Conditions	Status
Cab	Damp heat steady state	IEC/EN 60068-2-78 MIL-STD-810D section 507.2	Temperature: 40 ± 2 °C Relative humidity: 93 +2/-3 % Duration: 56 days	Converter not operating
Kb	Salt mist, cyclic (sodium chloride NaCl solution)	IEC/EN 60068-2-52	Concentration: 5% (30°C) for 2 hours Storage: 40°C, 93% rel. humidity for 22 hours Number of cycles: 3 (= 3 days)	Converter not operating
Eb	Bump (half-sinusoidal)	IEC/EN 60068-2-29 MIL-STD-810D section 516.3	Acceleration amplitude: 25 g _n = 245 m/s ² Bump duration: 11 ms Number of bumps: 6000 (1000 in each direction)	Converter operating
Fc	Vibration (sinusoidal)	IEC/EN 60068-2-6 MIL-STD-810D section 514.3	Acceleration amplitude: 0.35 mm (10 – 60 Hz) 5 g _n = 49 m/s ² (60 - 2000 Hz) Frequency (1 Oct/min): 10 – 2000 Hz Test duration: 7.5 hours (2.5 hours in each axis)	Converter operating
Ea	Shock (half-sinusoidal)	IEC/EN 60068-2-27 MIL-STD-810D section 516.3	Acceleration amplitude: 50 g _n = 490 m/s ² Bump duration: 11 ms Number of bumps: 18 (3 in each direction)	Converter operating
--	Shock	EN 50155 / EN 61373 sect. 10, class A and B body mounted ①	Acceleration amplitude: 5.1 g _n Bump duration: 30 ms Number of bumps: 18 (3 in each direction)	Converter operating
Fda	Random vibration wide band Reproducibility high	IEC/EN 60068-2-35 DIN 40046 part 23	Acceleration spectral density: 0.05 g _n ² /Hz Frequency band: 20 – 500 Hz Acceleration magnitude: 4.9 g _{rms} Test duration: 3 hours (1 hour in each axis)	Converter operating
--	Simulated long life testing at increased random vibration levels	EN 50155 / EN 61373 sect. 9, cat 1, class B, body mounted ①	Acceleration spectral density: 0.02 g _n ² /Hz Frequency band: 5 – 150 Hz Acceleration magnitude: 0.8 g _{rms} Test duration: 15 hours (5 hours in each axis)	Converter operating

① Body mounted = chassis of a railway coach

Technical Notes

Start-Up Threshold and Undervoltage Shutdown

Under normal start-up conditions, the UCR Series will not begin to regulate properly until the ramping input voltage exceeds the Start-Up Threshold. Once operating, devices will turn off when the applied voltage drops below the Undervoltage Shutdown point. Devices will remain off as long as the undervoltage condition continues. Units will automatically re-start when the applied voltage is brought back above the Start-Up Threshold. The hysteresis built into this function avoids an indeterminate on/off condition at a single input voltage. See Performance/Functional Specifications table for actual limits.

Start-Up Time

The V_{IN} to V_{OUT} Start-Up Time is the interval between the point at which a ramping input voltage crosses the Start-Up Threshold voltage and the point at which the fully loaded output voltage enters and remains within its specified ±1% 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 that the converter is turned off via the Remote On/Off Control with the nominal input voltage already applied.

On/Off Control

The primary-side, Remote On/Off Control function is off when On/Off is high/open and on when On/Off is pulled low or grounded. See Figure 4.

Dynamic control of the remote 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 be able to sink appropriate current (see Performance Specifications) when activated and withstand appropriate voltage when deactivated.

Current Limiting

When power demands from the output falls within the current limit inception range for the rated output current, the DC-DC converter will go into a current limiting mode. In this condition the output voltage will decrease proportionately with increases in output current, thereby maintaining a somewhat constant power dissipation. This is commonly referred to as power limiting. Current limit inception is defined as the point where the full-power output voltage falls below the specified tolerance. If the load current being drawn from the converter is significant enough, the unit will go into a short circuit condition. See “Short Circuit Condition.”

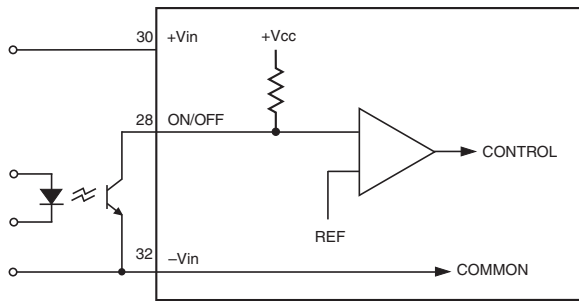


Figure 4. Driving the Remote On/Off Control Pin

Short Circuit Condition

When a converter is in current limit mode the output voltages will drop as the output current demand increases. If the output voltage drops too low, the magnetically coupled voltage used to develop primary side voltages will also drop, thereby shutting down the PWM controller. Following a time-out period, the PWM will restart, causing the output voltages to begin ramping to their appropriate values. If the short-circuit condition persists, another shutdown cycle will be initiated. This on/off cycling is referred to as "hiccup" mode. The hiccup cycling reduces the average output current, thereby preventing internal temperatures from rising to excessive levels. The UCR is capable of enduring an indefinite short circuit output condition.

Thermal Shutdown

UCR converters are equipped with thermal-shutdown circuitry. If the internal temperature of the DC-DC converter rises above the designed operating temperature (See Performance Specifications), a precision temperature sensor will power down the unit. When the internal temperature decreases below the threshold of the temperature sensor, the unit will self start.

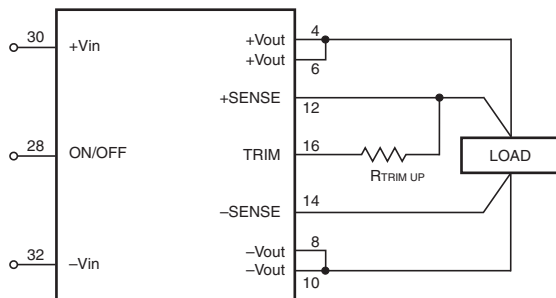


Figure 5. Trim Connections to Increase Output Voltage Using Fixed Resistors

$$R_{\text{TRIM UP}} (\text{k}\Omega) = \frac{4 \times (V_{\text{out}} - 2.5\text{V})}{2.5\text{V} \times (V_{\text{out}} \div V_{\text{nom}} - 1)}$$

Output Overvoltage Protection

The output voltage is monitored for an overvoltage condition via magnetic coupling to the primary side. If the output voltage rises to a fault condition, which could be damaging to the load circuitry (see Functional Specifications), the sensing circuitry will power down the PWM controller causing the output voltage to decrease. Following a time-out period the PWM will restart, causing the output voltage to ramp to its appropriate value. If the fault condition persists, and the output voltages again climb to excessive levels, the overvoltage circuitry will initiate another shutdown cycle. This on/off cycling is referred to as "hiccup" mode.

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 a sustained, non-current-limited, input-voltage polarity reversal exists. For MPS UCR Series DC-DC Converters, fast-blow fuses are recommended with values no greater than twice the maximum input current.

Fuse Specifications

Model	Fuse Type	Reference and rating
UCR100-050-T72-C	Fast-blow	15A 250V
UCR100-120-T72-C	Fast-blow	18A 250V
UCR100-240-T72-C	Fast-blow	20A 250V

Trimming Output Voltage

UCR converters have a trim capability that enables users to adjust the output voltage from -10% to +10% of V_{nominal}. Adjustments to the output voltage can be accomplished with a single fixed resistor as shown in Figures 5 and 6. A single fixed resistor can increase or decrease the output voltage depending on its connection. Resistors should be located close to the converter and have TCR's less than 100ppm/°C to minimize sensitivity to changes in temperature. If the trim function is not used, leave the trim pin open.

Trim adjustments greater than the specified -10% to +10% can have an adverse affect on the converter's performance and are not recommended. Excessive voltage differences between V_{OUT} and Sense, in conjunction with trim adjustment of the output voltage, can cause the overvoltage protection circuitry to activate (see Functional Specifications for overvoltage limits).

Use only one trim up or trim down resistor. **Do not** connect both resistors simultaneously. When trimming, do not exceed maximum output power.

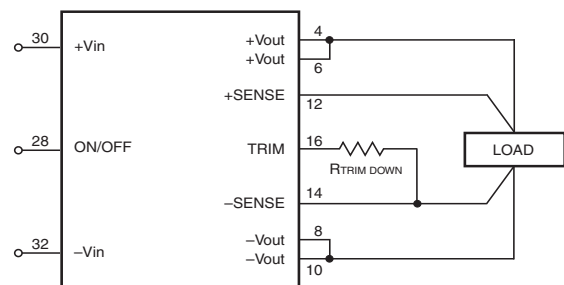


Figure 6. Trim Connections to Decrease Output Voltage Using Fixed Resistors

$$R_{\text{TRIM DOWN}} (\text{k}\Omega) = \frac{4 \times V_{\text{out}}}{V_{\text{nom}} - V_{\text{out}}}$$

Remote Sense

UCR series converters employ a sense feature to provide point of use regulation, thereby overcoming moderate IR drops in pcb conductors or cabling. The remote sense lines carry very little current and therefore require minimal cross-sectional-area conductors. The sense lines, which are capacitively coupled to their respective output lines, are used by the feedback control-loop to regulate the output. As such, they are not low impedance points and must be treated with care in layouts and cabling. Sense lines on a pcb should be run adjacent to dc signals, preferably ground. In cables and discrete wiring applications, twisted pair or other techniques should be implemented.

UCR series converters will compensate for drops between the output voltage at the DC-DC converter output pins and the voltage at the DC-DC sense input pins provided that:

$$[V_{OUT(+)} - V_{OUT(-)}] - [Sense(+) - Sense(-)] \leq 10\% V_{OUT}$$

Output overvoltage protection is monitored at the output voltage pin, not the Sense pin. Therefore, excessive voltage differences between V_{OUT} and Sense in conjunction with trim adjustment of the output voltage can cause the overvoltage protection circuitry to activate (see Performance Specifications for overvoltage limits). Power derating is based on maximum output current and voltage at the converter's output pins. Use of trim and sense functions can cause output voltages to increase, thereby increasing output power beyond the converter's specified rating, or cause output voltages to climb into the output overvoltage region. Therefore, the designer must ensure:

$$(V_{OUT \text{ at pins}}) \times (I_{OUT}) \leq \text{rated output power}$$

Note: The Sense and V_{OUT} lines are internally connected through low-value resistors. Nevertheless, if the sense function is not used for remote regulation the user must connect the +Sense to + V_{OUT} and -Sense to - V_{OUT} at the DC-DC converter pins.

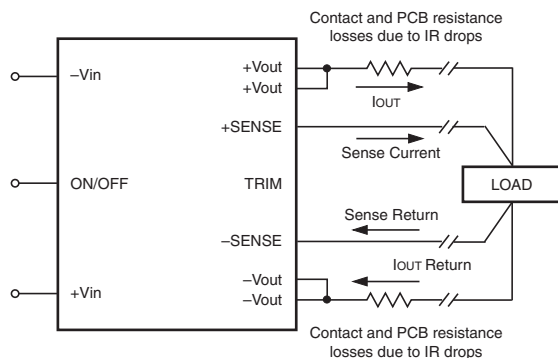


Figure 7. Remote Sense Circuit Configuration

Conformal Coating

The UCR modules have conformal coating to protect them against moisture, dust, and chemical and temperature extremes during all types of applications. They provide environmental and mechanical protection to extend the life of the components and circuitry significantly. Conformal coating on the UCR modules is applied by dipping. Conformal coating protects the UCR modules from moisture and contaminants, preventing short circuits and corrosion of conductors and solder joints. In addition, the use of conformal coating protects circuits and components from abrasion and solvents. Stress relief is also provided, as well as protection of the insulation resistance of the module. The conformal coating is particularly useful for protecting circuitry in severe service environments, while maintaining a low stress environment for components and connections.

Features and Options

Hold-Up Time

The hold-up time function provided by the UCR100 is designed to work with an external hold-up capacitor that is charged from circuitry internal to the converter. Hold-up time is defined as the duration of time that the DC-DC converter output will remain active following a loss of input power. When the hold-up function is activated, the UCR100 uses the hold-up capacitor energy to support operation. This provides a charge that maintains the DC-DC converter in operation for 10ms of hold-up time. The capacitors in the application are recommended below. The values in the table are standard capacitor values that will provide a hold-up time of better than 10ms.

Vin	24V	36V	48V	72V	96V	110V
Standard	1900µf	1000µf	860µf	680µf	510µf	1200µf
Working Voltage	75VDC	100VDC	100VDC	150VDC	150VDC	150VDC

Figure 8 shows the relationship between the input voltage and the fall of the output voltage.

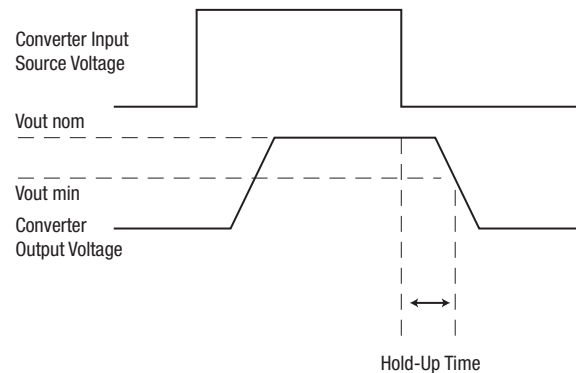


Figure 8. Hold-up Time to DC-DC Converter

Figure 9 shows the connection of the external output capacitor for the UCR100 model.

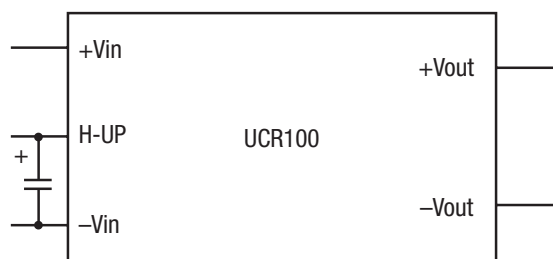


Figure 9. Connection of External Hold-up Capacitor

Undervoltage Lockout

URC series converters with the -V or -SV suffix have an undervoltage lockout feature that will shut down the controller if the input voltage falls below an adjustable threshold. The undervoltage threshold is determined by the value of a resistor placed between the UVLO and -Vin. Figure 10 shows a typical configuration.

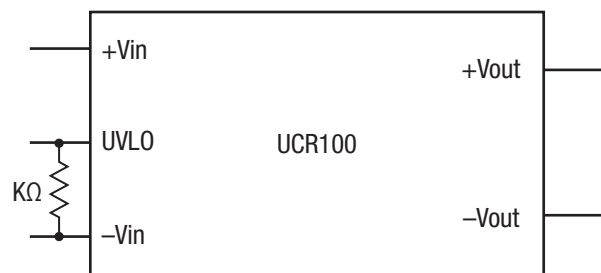


Figure 10. Undervoltage Lockout Configuration

The converter will remain off as long as the input voltage remains below the UVLO threshold. Devices will automatically restart when the applied voltage rises above the UVLO threshold. The hysteresis built into this function prevents an indeterminate on/off condition at a single input voltage. The table below shows common UVLO values for various nominal input voltages and the required resistor value for each.

Vin Nominal (V)	24	36	48	72	96	110
UVLO (V)	14.4 (±1V)	21.6 (±1V)	28.8 (±1V)	43.2 (±1V)	57.6 (±1V)	66 (±1V)
UVLO External Trim Resistor (KΩ)	50	11.5	6.1	2.7	1.5	1.1

Using Multiple Converters

UCR converters may be connected in series to achieve a higher output voltage. URC converters with the optional current share feature (-S and -SV models) may also be connected in parallel to support higher output current, to improve redundancy or to spread the thermal load in high power, high temperature environments. Please refer to the typical circuits below. For all modes, use short connections with sufficient wire gauge and adequate grounding. Trim circuits are not shown in the following diagrams however they are the same as the Output Adjustment section.

A desirable feature of using multiple converters is that, since all units are isolated, they can use a common input power supply. Or you may use separate inputs for redundancy.

When using units with the load share option in stand-alone operation with the remote sense feature, the load share pin must be connected to -Vout. This connection is not needed if the remote sense lines are connected directly at the connector.

Using series connections (see figure 11)

Figure 11 illustrates a typical configuration for two URC converters connected in series. The Current Share inputs should be left floating or tied to -Vout. When connected in series the maximum load regulation remains constant as a percentage of the series output voltage. The total percentage of regulation does not change over the series string however the regulation amounts (in millivolts) accumulate in each converter.

When trimming UCRs in a series-connected chain, be sure to avoid exceeding the voltage trim limits for each individual converter. Specifically, try to make the trim adjustments approximately equal on all series-connected converters.

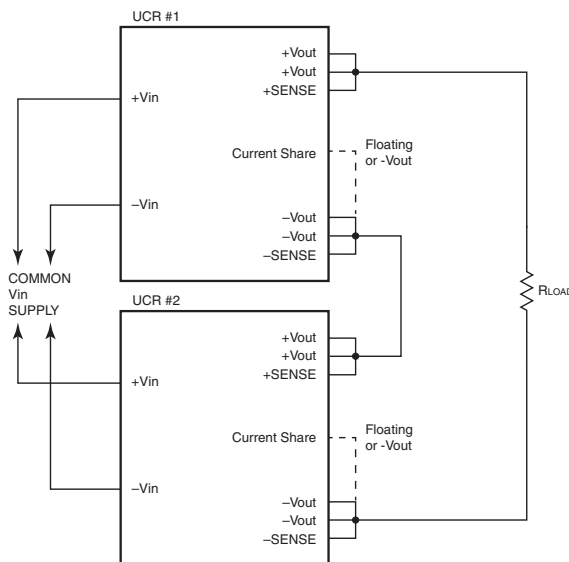


Figure 11. Series Connections

Using parallel connections – Load Sharing (see figure 12)

The +Sense must be left open when current sharing is required. Be sure to differentiate between wiring for redundancy or wiring for load sharing which is greater than one converter's output current rating. Redundant connections

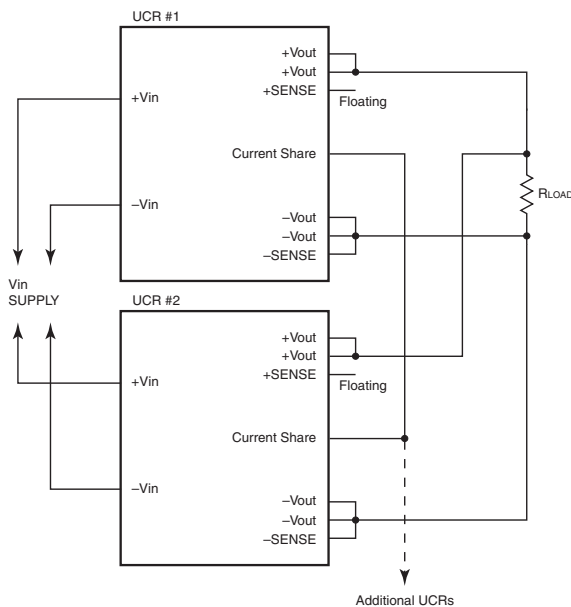


Figure 12. Load-Sharing Parallel Connections

expect one or the remaining converters to absorb the whole load if one converter fails. Therefore the entire load cannot exceed the rating of one converter.

Load sharing requires all parallel converters to be operational since failure of one converter forces all others to go into overcurrent shutdown. For two or more parallel load sharing converters, connect all Current Share pins together. The load-share parallel current circuit requires interconnection of the Current Share pins between each converter to insure that the current load is approximately balanced between all converters.

Using parallel connections – Redundancy

The redundancy connections in figures 13 and 14 requires external user-supplied “OR’ing” diodes to share the load. The diodes prevent one converter with slightly higher voltage forcing current into the lower-current converter. The diodes also protect the application against catastrophic “crow-barring” failure (shorted output) by one of the converters.

The diodes should be identical part numbers to enhance balance between the two converters. The default factory nominal voltage should be sufficiently matched between converters however you may wish to add optional external trim circuits to make the load approximately equal. Adjust the converters for equal output voltage before connecting in parallel.

The OR’ing diode system is the responsibility of the user. Be aware of the power levels applied to the diodes and possible heat sink requirements.

Be very careful placing the diodes “in the loop” when using Sense inputs. This might cause the output terminals to exceed their +10% trim range or maximum power outputs. Schottky power diodes with approximately 0.3 Volt

drops may be suitable in the loop whereas 0.7 Volt silicon power diodes may not be advisable. The Sense inputs are being asked to compensate for both the diode drop and the wiring losses. Placing the diodes “in the loop” provides better system regulation at the risk of exceeding power levels (see figure 14).

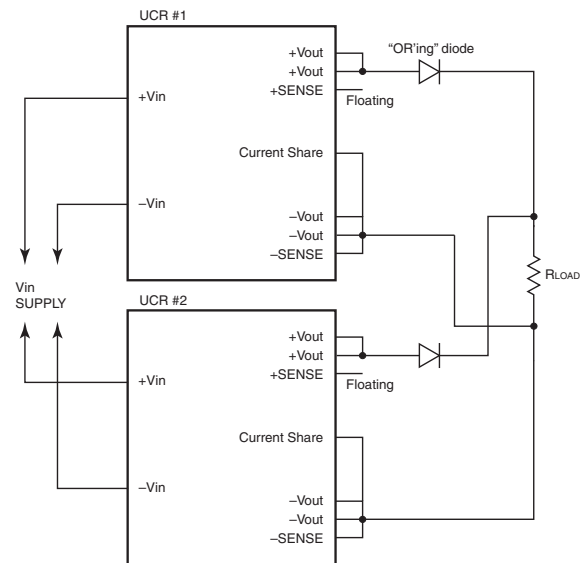


Figure 13. Redundant Parallel Connections

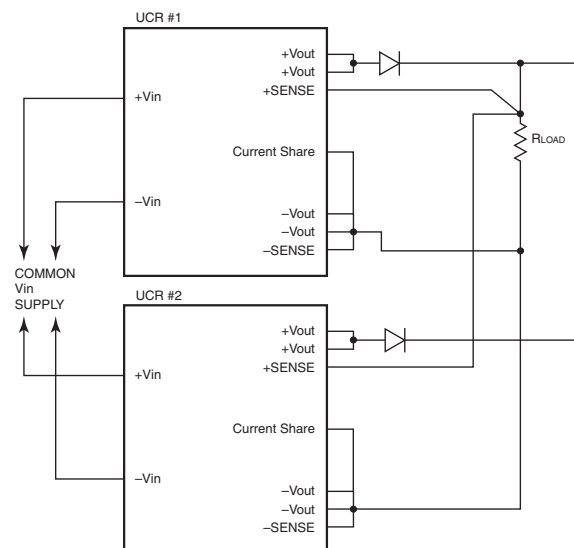


Figure 14. Optional Redundant Parallel Sense Wiring



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