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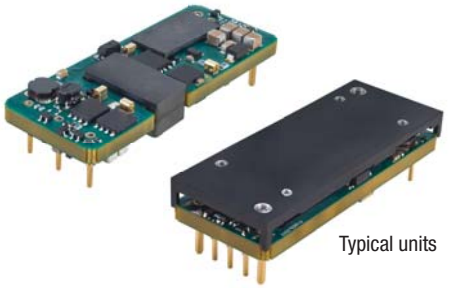
UWE-100-120W Series

Wide Input, Isolated Eighth-Brick DC-DC Converters



Typical units

The UWE Series "Eighth-Brick" DC-DC Converters are high-current isolated power modules designed for use in high-density system boards.

FEATURES

- Industry-standard through-hole eighth-brick package
- Wide input range of 18-75Vdc or 9-36Vdc (12Vout only)
- Fixed outputs from 3.3, 5 and 12 Volts DC up to 120 Watts
- Synchronous rectification yields very high efficiency and low power dissipation
- Operating temperature range from -40°C to +85˚C with derating
- Up to 2250 Volt DC isolation
- Outstanding thermal performance and derating
- Extensive self-protection, over temperature and overload features
- On/Off control, trim and remote sense functions
- Certified to UL/EN/IEC 60950-1, CAN/CSA-C22.2 No. 60950-1, 2nd Edition, safety approvals and EN55022/CISPR22 standards
- Pre-bias operation for startup protection

PRODUCT OVERVIEW

The UWE series open frame DC-DC converters deliver up to 120 Watts in an industry-standard "eighth-brick" through-hole package. This format can plug directly into quarter-brick pin outs. Several standard fixed-output voltages from 3.3 Vdc to 12 Vdc assure compatibility in embedded equipment, CPU cards and instrument subsystems. The extended 4-to-1 input voltage range is ideal for battery-powered, telecom or portable applications. Very high efficiency means no fans or temperature deratings in many applications. An optional baseplate extends operation into most conceivable environments.

The synchronous rectifier design uses the maximum available duty cycle for greatest efficiency and low power dissipation. These devices deliver low output noise, tight line/load regulation, stable no-load operation and fast load step response. All units are precision assembled in a highly automated facility with ISO-traceable manufacturing quality standards. Isolation of 2250 Volts assures safety and fully differential (floating) operation for greatest application flexibility. On-board Sense terminals compensate for load line voltage errors at high output currents. Outputs are trimmable within ±10% of nominal voltage.

A wealth of protection features prevents damage to both the converter and outside circuits. Inputs are protected from under voltage and outputs feature short circuit protection, over current and over temperature shut down. Overloads automatically recover using the "hiccup" technique upon fault removal. The UWE is certified to standard safety and EMI/RFI approvals. All units meet RoHS-6 hazardous materials compliance.

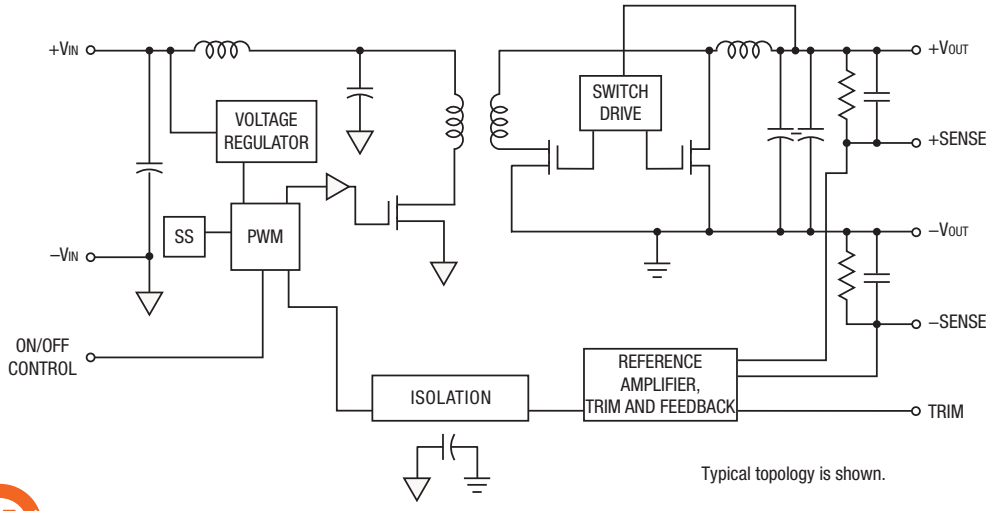


Figure 1. Simplified Block Diagram

RoHS COMPLIANT

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

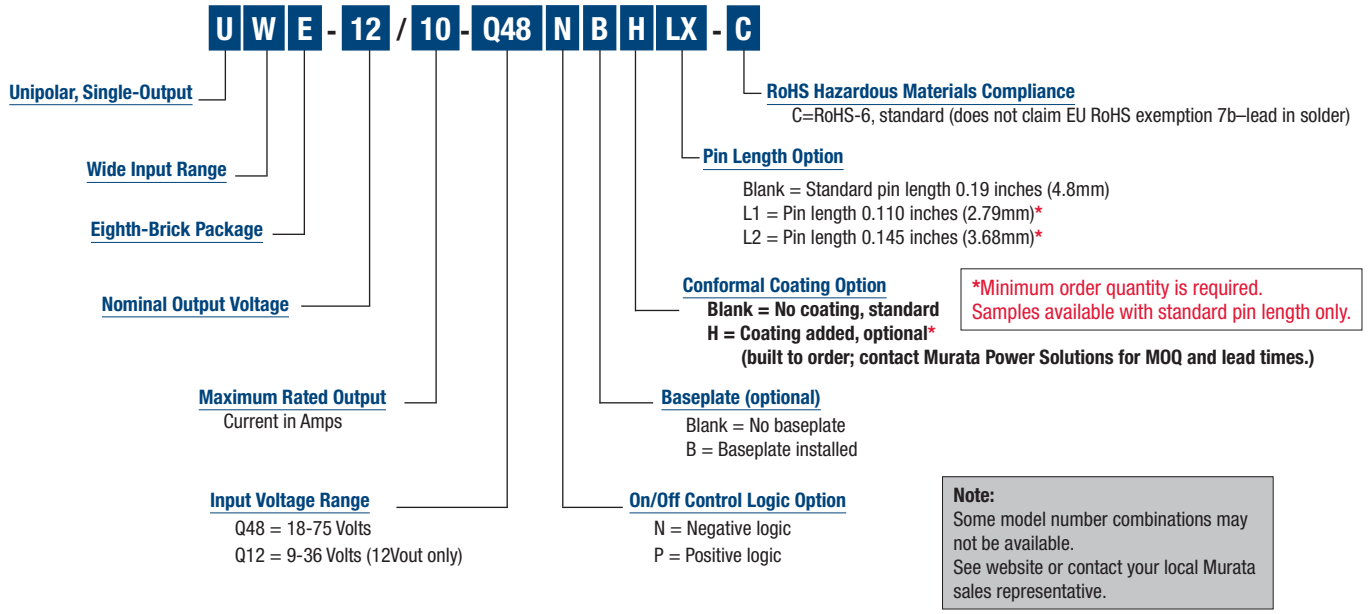
c UL us

SPECIFICATION SUMMARY AND ORDERING GUIDE ①②③

Root Model ①	Output							Input				Efficiency		Dimensions	
	V_{OUT} (V) ④	I_{OUT} (A)	Power (W)	R/N (mVp-p)		Regulation (%)		V_{IN} Nom. (V)	Range (V)	I_{IN}, min load (mA)	I_{IN}, full load (A)	Min.	Typ.	Case (Inches)	Case (mm)
				Typ.	Max.	Line	Load								
UWE-3.3/30-Q48-C	3.3	30	99	90	125	±0.2	±0.2	48	18-75	90	2.30	88%	89.5%	2.3x0.9x0.39	58.42x22.86x9.91
UWE-5/20-Q48-C	5	20	100	75	110	±0.1	±0.2	48	18-75	100	2.30	89%	90.5%	2.3x0.9x0.39	58.42x22.86x9.91
UWE-12/10-Q48-C	12	10	120	115	200	±0.15	±0.075	48	18-75	110	2.732	90%	91.5%	2.3x0.9x0.39	58.42x22.86x9.91
UWE-12/10-Q12-C	12	10	120	115	200	±0.15	±0.075	12	9-36	260	10.95	89.5%	91.3%	2.3x0.9x0.34	58.42x22.86x8.64

① Please refer to the part number structure for additonal ordering model numbers and options.
② All specifications are typical at nominal line voltage, nominal output voltage and full load, +25°C unless otherwise noted. See detailed specifications.
③ External capacitors used for testing: with appropriate voltage and current ratings, output capacitors are 1 µF in parallel with 10 µF. Input cap is 33 µF. All caps are low ESR types. Contact Murata Power Solutions for details.
④ I/O caps are necessary for our test equipment. The values and number of capacitors may be modified depending on the application.

PART NUMBER STRUCTURE



Customer Configured Part Numbers:
1. UWE-31311-C (special version of the UWE-12/10-Q48NB-C)
   a. Includes conformal coating
   b. Isolation tested to 2,828Vdc Input-to-Output per IEEE 1613
   c. Pin length of 0.180 inches ±0.02 (4.6mm ±0.508)

FUNCTIONAL SPECIFICATIONS, UWE-3.3/30-Q48

ABSOLUTE MAXIMUM RATINGS	CONDITIONS AND COMMENTS ①	MINIMUM	TYPICAL/NOMINAL	MAXIMUM	UNITS
Input Voltage, Continuous	Full power operation			80	Vdc
Input Voltage, Transient	Operating or non-operating, 100 mS max. duration			100	Vdc
Isolation Voltage	Input to output			2250	Vdc
Input Reverse Polarity	None, install external fuse		None		Vdc
On/Off Remote Control	Power on or off, referred to -Vin	0		15	Vdc
Output Power		0		99.99	W
Output Current	Current-limited, no damage, short-circuit protected	0		30	A
Storage Temperature Range	Vin = Zero (no power)	-55		125	°C
Absolute maximums are stress ratings. Exposure of devices to greater than 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 or recommended.					
INPUT	**CONDITIONS AND COMMENTS ① ③**				
Operating voltage range		18	48	75	Vdc
Recommended External Fuse	Fast blow			12	A
Start-up threshold, Turn On	Rising input voltage	16.5	17	17.9	Vdc
Undervoltage shutdown, Turn Off	Falling input voltage	15.5	16.5	17.5	Vdc
Turn-On/Turn-Off Hysteresis		0.86	1.05	1.25	Vdc
Overvoltage shutdown			NA		Vdc
Reverse Polarity Protection	None, install external fuse		None		Vdc
Internal Filter Type			Pi-type		
Input current					
Full Load Conditions	Vin = nominal		2.304	2.367	A
Low Line	Vin = minimum		6.145	6.349	A
Inrush Transient			0.1		A^2-Sec.
Short Circuit Input Current			150	200	mA
No Load Input Current	Iout = minimum, unit=ON		90	125	mA
Standby Mode Input Current (Off, UV, OT)			4	8	mA
Reflected (back) ripple current ②	no filtering		500	700	mA, P-P
Reflected (back) ripple current ②	Measured at input with specified filter		50	70	mA, P-P
Pre-biased startup	Monotonic				
GENERAL AND SAFETY					
Efficiency	Vin=24V, full load	89	90		%
	Vin=min. to max.	87.5	89		%
	Vin=48V, full load	88	89.5		%
Isolation					
Isolation Voltage, input to output	No baseplate	2250			Vdc
Isolation Voltage, input to output	With baseplate	2250			Vdc
Isolation Voltage, input to baseplate	With baseplate	1500			Vdc
Isolation Voltage, output to baseplate	With baseplate	750			Vdc
Insulation Safety Rating			basic		
Isolation Resistance			100		MΩ
Isolation Capacitance			1000		pF
Safety	Certified to UL-60950-1, CSA-C22.2 No.60950-1, IEC/EN60950-1, 2nd edition (pending)		Yes		
Calculated MTBF	Per Telcordia SR332, issue 1, class 3, ground fixed, Tambient=+40C		TBD		Hours x 10^3
DYNAMIC CHARACTERISTICS					
Fixed Switching Frequency		195	215	235	KHz
Startup Time	Power on, Vout regulated		20	30	mS
Startup Time	Remote ON to Vout regulated		10	20	mS
Dynamic Load Response	50-75-50% load step, settling time to within 2% of Vout.		50	200	µSec
Dynamic Load Peak Deviation	same as above		±500		mV
FEATURES AND OPTIONS					
Remote On/Off Control ④					
"N" suffix:					
Negative Logic, ON state	ON = Pin grounded or external voltage	0		1	V
Negative Logic, OFF state	OFF = Pin open or external voltage	3.5		15	V
Control Current	open collector/drain		1	2	mA
"P" suffix:					
Positive Logic, ON state	ON = Pin open or external voltage	3.5		15	V
Positive Logic, OFF state	OFF = Ground pin or external voltage	0		0.8	V
Control Current	open collector/drain		1	2	mA
Base Plate	"B" suffix				

FUNCTIONAL SPECIFICATIONS, UWE-3.3/30-Q48 (CONT.)

OUTPUT					
Total Output Power		0	99	99.99	W
Voltage					
Nominal Output Voltage	No trim	3.267	3.3	3.333	Vdc
Settling Accuracy	At 50% load	-1		1	% of Vset.
Output Voltage Range	User-adjustable (see trim formulas)	-10		10	% of Vnom.
Overvoltage Protection	Via magnetic feedback		3.8	4.5	Vdc
Current					
Output Current Range		0	30	30	A
Minimum Load	No minimum load				
Current Limit Inception	98% of Vnom., after warmup	33	35	44	A
Short Circuit					
Short Circuit Current	Hiccup technique, autorecovery within ±1% of Vout		5	10	A
Short Circuit Duration (remove short for recovery)	Output shorted to ground, no damage		Continuous		
Short circuit protection method	Hiccup current limiting				
Regulation					
Line Regulation	Vin=min. to max., Vout=nom., nom load		±0.2		% of Vout
Load Regulation	Iout=min. to max		±0.2		% of Vout
Ripple and Noise ②	5 Hz- 20 MHz BW		90	125	mV pk-pk
Temperature Coefficient	At all outputs		0.02		% of Vout./°C
Maximum Capacitive Loading	Low ESR	0	4700	10,000	µF
MECHANICAL (THROUGH HOLE MODELS)					
Outline Dimensions			2.3x.9x.39		Inches
(Please refer to outline drawing)	LxWxH		58.42x22.86x9.91		mm
Weight (without baseplate)			0.7		Ounces
			20		Grams
Weight (with baseplate)			12.9		Ounces
			36.5		Grams
Through Hole Pin Diameter	Diameter of pins standard		0.062 & 0.04		Inches
			1.575 & 1.016		mm
Through Hole Pin Material			Copper alloy		
TH Pin Plating Metal and Thickness	Nickel subplate		50		µ-inches
	Gold overplate		5		µ-inches
Baseplate Material			Aluminum		
ENVIRONMENTAL					
Operating Ambient Temperature Range	See derating	-40		85	°C
Storage Temperature	Vin = Zero (no power)	-55		125	°C
Operating Base Plate Temp	No derating required	-40		100	
Thermal Protection/Shutdown	Measured at hotspot	135	140	150	°C
Electromagnetic Interference	External filter is required				
Conducted, EN55022/CISPR22			B		Class
Radiated, EN55022/CISPR22			B		Class
RoHS rating			RoHS-6		

Notes

① Unless otherwise noted, all specifications are at nominal input voltage, nominal output voltage and full load.
General conditions are +25° Celsius ambient temperature, near sea level altitude, airflow of 300lfm for extended operation time.
All models are tested and specified with external parallel 1 µF and 10 µF output capacitors.
A 33µF external input capacitor with appropriate voltage and current rating is used. All capacitors are low-ESR types wired close to the converter. The values and number of capacitors may be modified depending on the application.

② Input (back) ripple current is tested and specified over 5 Hz to 20 MHz bandwidth. Input filtering is Cbus=220 µF, Cin=33 µF and Lbus=12 µH.

③ All models are stable and regulate to specification under no load.

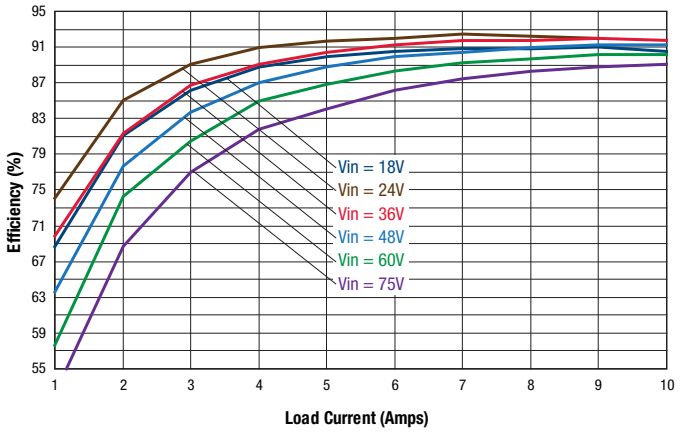
④ The Remote On/Off Control is referred to -Vin. For external transistor control, use open collector logic or equivalent.

⑤ NOTICE—Please use only this customer data sheet as product documentation when laying out your printed circuit boards and applying this product into your application. Do NOT use other materials as official documentation such as advertisements, product announcements, or website graphics.
We strive to have all technical data in this customer data sheet highly accurate and complete. This customer data sheet is revision-controlled and dated. The latest customer data sheet revision is normally on our website (www.murata-ps.com) for products which are fully released to Manufacturing. Please be especially careful using any data sheets labeled "Preliminary" since data may change without notice. Please be aware of small details that may affect your application and PC board layouts. Study the Mechanical Outline drawings, Input/Output Connection table and all footnotes very carefully. Please contact Murata Power Solutions if you have any questions.

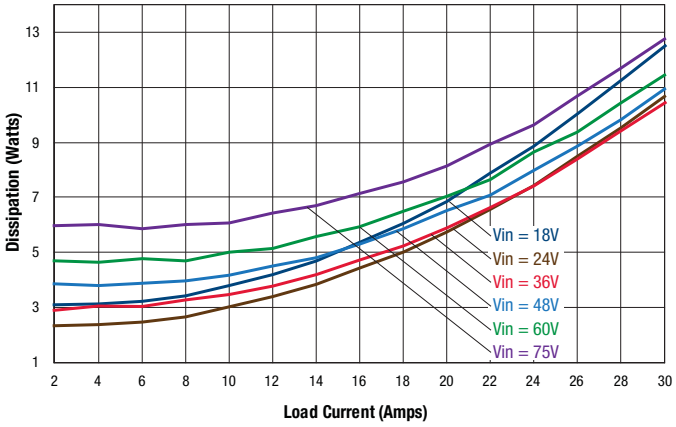
⑥ If reverse polarity is accidentally applied to the input, to ensure reverse input protection, always connect an external input fuse in series with the +VIN input. Use approximately twice the full input current rating with nominal input voltage.

PERFORMANCE DATA, UWE-3.3/30-Q48

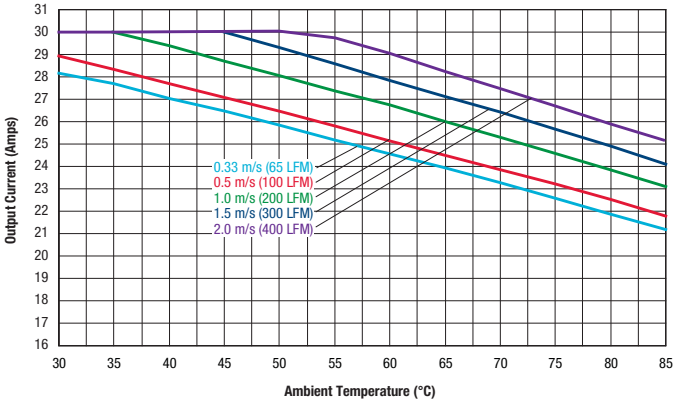
Efficiency vs. Line Voltage and Load Current @ 25°C



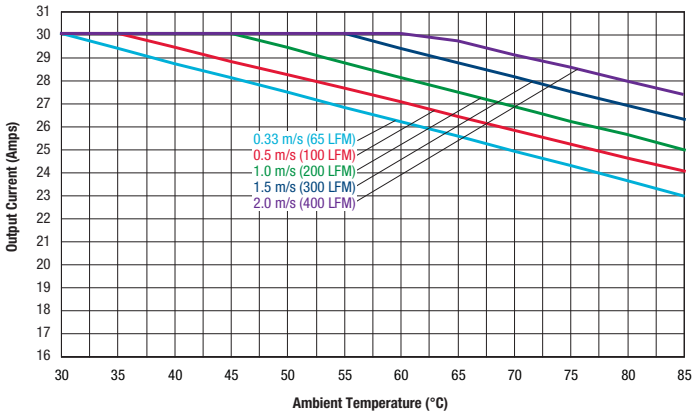
Power Dissipation vs. Line and Load



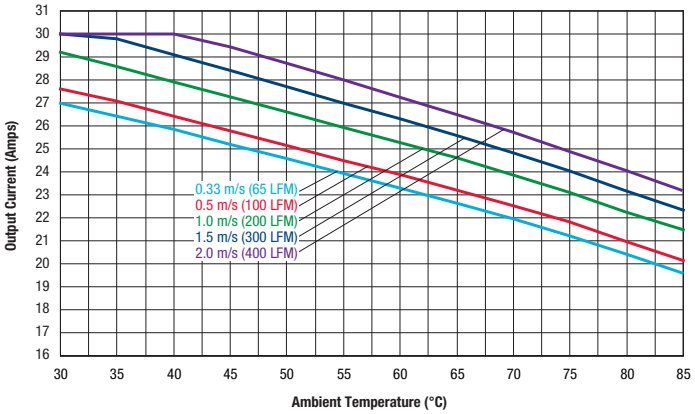
Maximum Current Temperature Derating @ sea level (VIN = 24V, air flow from Pin 3 to Pin 1, no baseplate)



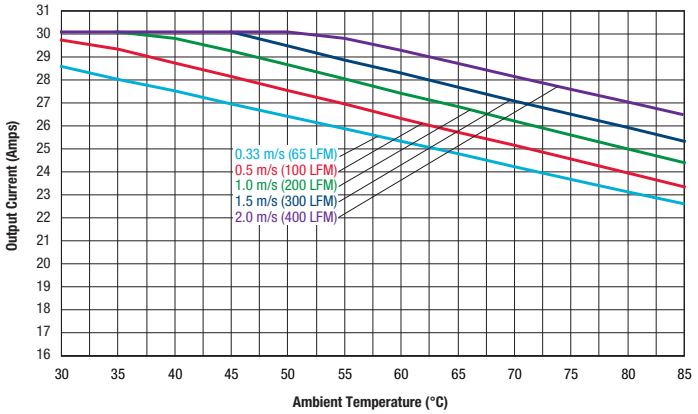
Maximum Current Temperature Derating @sea level (VIN = 24V, air flow from Pin 3 to Pin 1, with baseplate)



Maximum Current Temperature Derating @sea level (VIN = 48V, air flow from Pin 3 to Pin 1, no baseplate)

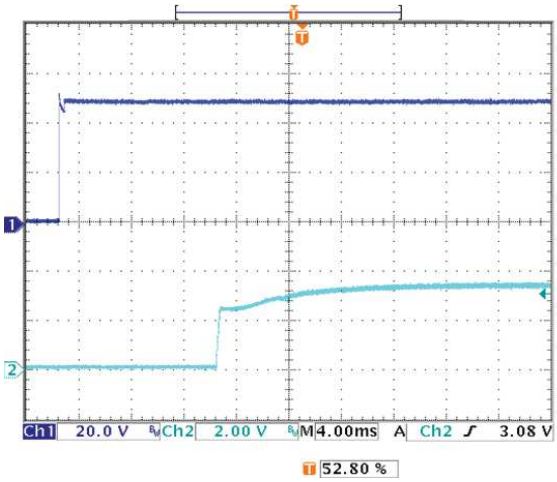


Maximum Current Temperature Derating @sea level (VIN = 48V, air flow from Pin 3 to Pin 1, with baseplate)

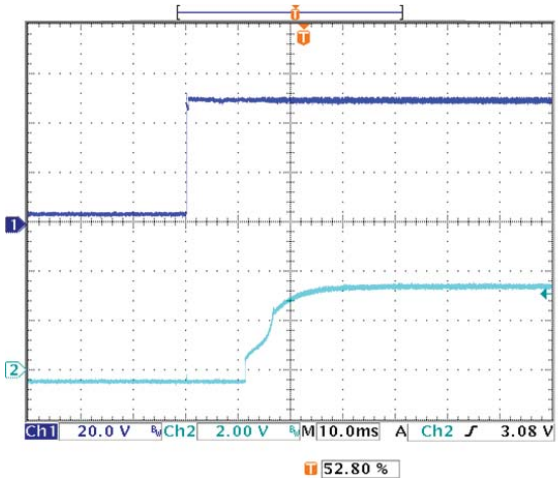


PERFORMANCE DATA, UWE-3.3/30-Q48

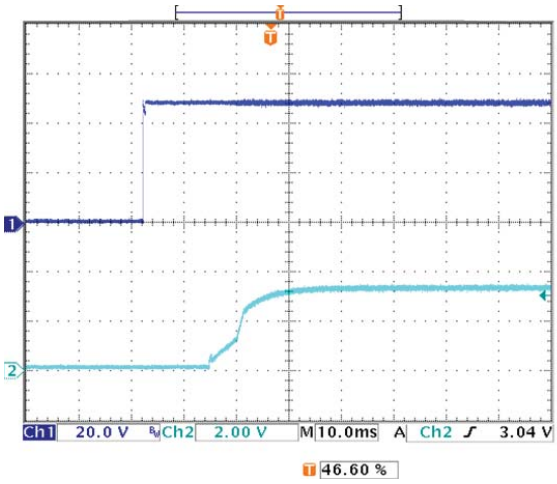
Startup Delay (Vin=48V, Iout=0A, Cout=0, Ta=+25°C) Trace1=Vin, Trace2=Vout.



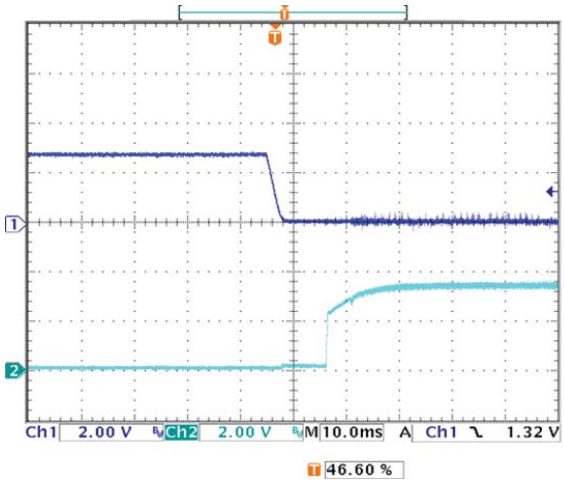
Startup Delay (Vin=48V, Iout=30A, Cout=0, Ta=+25°C) Trace1=Vin, Trace2=Vout.



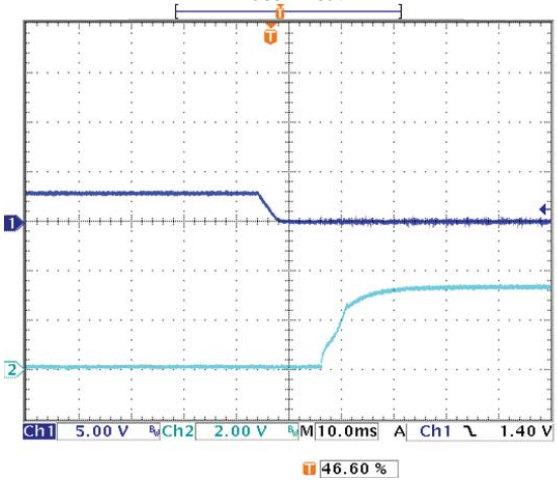
Startup Delay (Vin=48V, Iout=30A, Cout=10000µF, Ta=+25°C) Trace1=Vin, Trace2=Vout.



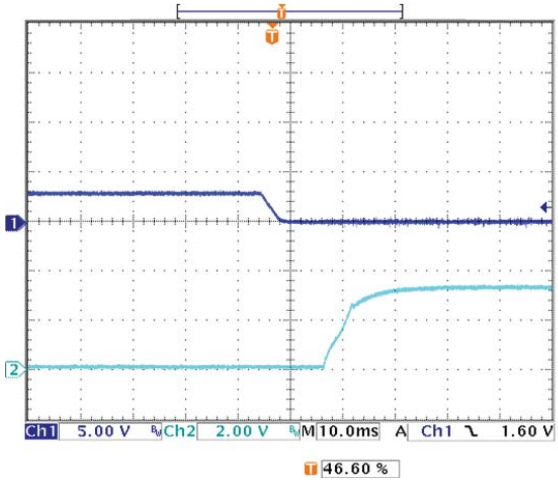
On/Off Enable Delay (Vin=48V, Iout=0A, Cout=0, Ta=+25°C) Trace1=Enable, race2=Vout.



On/Off Enable Delay (Vin=48V, Iout=30A, Cout=0, Ta=+25°C) Trace1=Enable, Trace2=Vout.

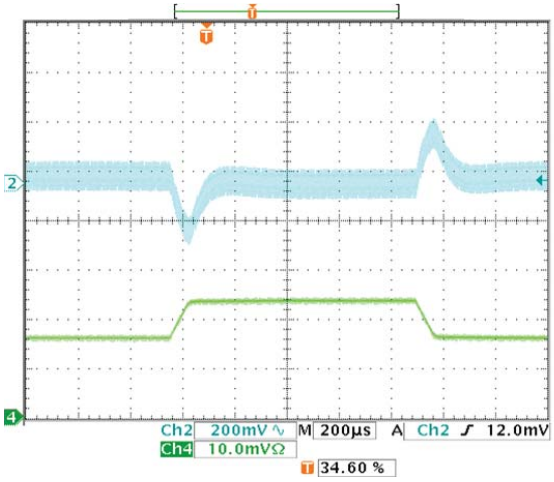


On/Off Enable Delay (Vin=48V, Iout=30A, Cout=10000µF, Ta=+25°C)

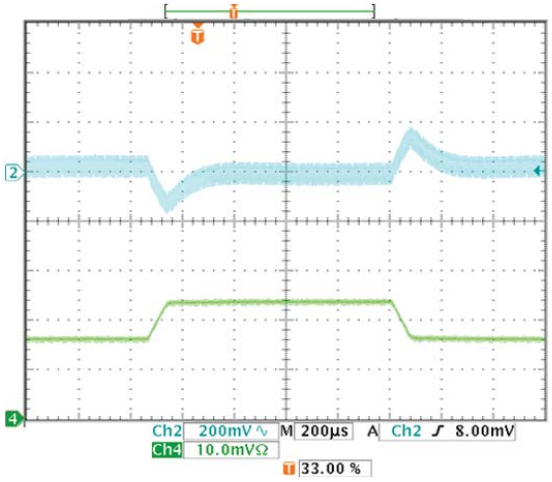


PERFORMANCE DATA, UWE-3.3/30-Q48

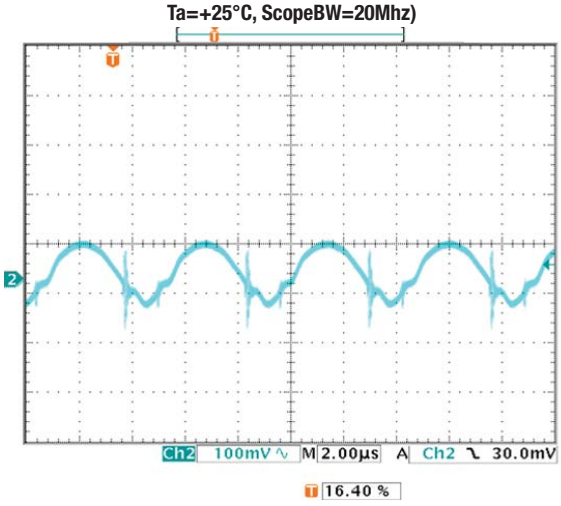
Steploat Transient Response (Vin=48V, Iout=50-75-50% of Iout, Cload= 1µF ll 10µF , Slew rate: 10A/uS at Ta=+25°C)



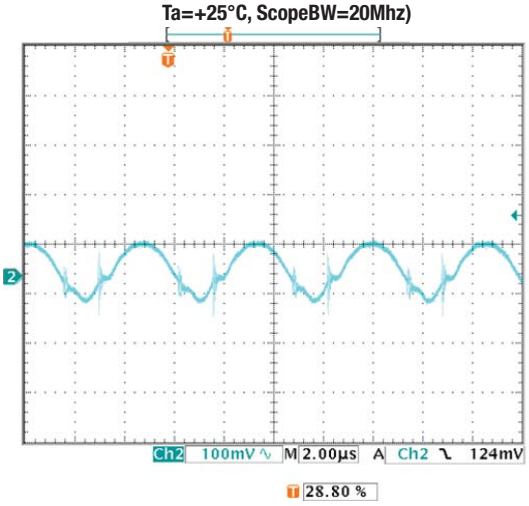
Steploat Transient Response (Vin=48V, Iout=50-75-50% of Iout, Cload= 1µF ll 10µF ll 10000µF , Slew rate: 10A/uS at Ta=+25°C)



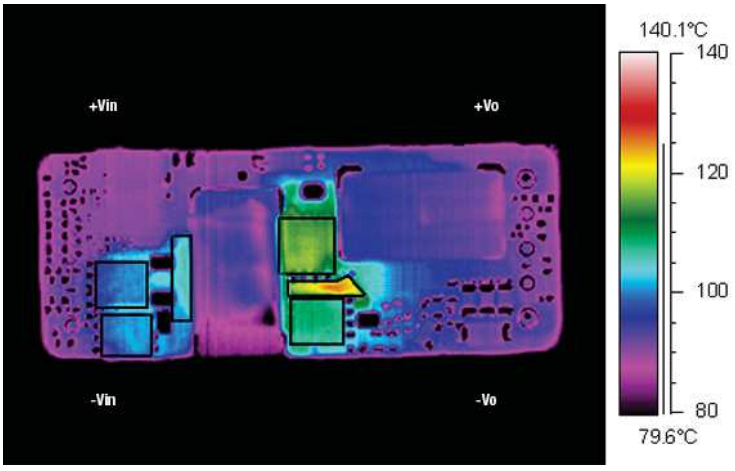
Output Ripple and Noise (Vin=48V, Vout=nom, Iout=0A, Cout=1F ll 10µF, Ta=+25°C, ScopeBW=20Mhz)



Output Ripple and Noise (Vin=48V, Vout=nom, Iout=30A, Cout=1F ll 10µF, Ta=+25°C, ScopeBW=20Mhz)



Thermal image with hot spot at 23.5A current with 25°C ambient temperature. Natural convection is used with no forced airflow. Identifiable and recommended maximum value to be verified in application. Vin=48V, Q14 and Copper are the hot spots.



FUNCTIONAL SPECIFICATIONS, UWE-5/20-Q48-C

ABSOLUTE MAXIMUM RATINGS	CONDITIONS AND COMMENTS ①	MINIMUM	TYPICAL/NOMINAL	MAXIMUM	UNITS
Input Voltage, Continuous	Full power operation			80	Vdc
Input Voltage, Transient	Operating or non-operating, 100 mS max. duration			100	Vdc
Isolation Voltage	Input to output			2250	Vdc
Input Reverse Polarity	None, install external fuse		None		Vdc
On/Off Remote Control	Power on or off, referred to -Vin	0		15	Vdc
Output Power		0		101	W
Output Current	Current-limited, no damage, short-circuit protected	0		20	A
Storage Temperature Range	Vin = Zero (no power)	-55		125	°C
Absolute maximums are stress ratings. Exposure of devices to greater than 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 or recommended.					
INPUT	**CONDITIONS AND COMMENTS ① ③**				
Operating voltage range		18	48	75	Vdc
Recommended External Fuse	Fast blow			10	A
Start-up threshold, Turn On	Rising input voltage	17	17.5	17	Vdc
Undervoltage shutdown, Turn Off : @10A load	Falling input voltage	15.5	16	17.5	Vdc
Turn-On/Turn-Off Hysteresis		1	1.5		Vdc
Overvoltage shutdown			NA		Vdc
Reverse Polarity Protection	None, install external fuse		None		Vdc
Internal Filter Type			L-C-type		
Input current					
Full Load Conditions	Vin = nominal		2.30	2.36	A
Low Line	Vin = minimum		6.11	6.27	A
Inrush Transient			0.1		A^2-Sec.
Short Circuit Input Current			250	350	mA
No Load Input Current	Iout = minimum, unit=ON		100	135	mA
Standby Mode Input Current (Off, UV, OT)			5	10	mA
Reflected (back) ripple current ②	no filtering		500	600	mA, P-P
Reflected (back) ripple current ②	Measured at input with specified filter		30	40	mA, P-P
Pre-biased startup	Monotonic				
GENERAL AND SAFETY					
Efficiency	Vin=24V, full load	90.5	92		%
	Vin=min. to max.	89.5	91		%
	Vin=48V, full load	89	90.5		%
Isolation					
Isolation Voltage, input to output	No baseplate	2250			Vdc
Isolation Voltage, input to output	With baseplate	2250			Vdc
Isolation Voltage, input to baseplate	With baseplate	1500			Vdc
Isolation Voltage, output to baseplate	With baseplate	750			Vdc
Insulation Safety Rating			basic		
Isolation Resistance			100		MΩ
Isolation Capacitance			1000		pF
Safety	Certified to UL-60950-1, CSA-C22.2 No.60950-1, IEC/EN60950-1, 2nd edition (pending)		Yes		
Calculated MTBF	Per Telcordia SR332, issue 1, class 3, ground fixed, Tambient=+40C		TBD		Hours x 10^3
DYNAMIC CHARACTERISTICS					
Fixed Switching Frequency		200	225	250	KHz
Startup Time	Power on, Vout regulated		20	30	mS
Startup Time	Remote ON to Vout regulated		20	30	mS
Dynamic Load Response	50-75-50% load step, settling time to within 2% of Vout.		100	200	µSec
Dynamic Load Peak Deviation	same as above		±450		mV
FEATURES AND OPTIONS					
Remote On/Off Control ④					
"N" suffix:					
Negative Logic, ON state	ON = Pin grounded or external voltage	0		0.8	V
Negative Logic, OFF state	OFF = Pin open or external voltage	3.5		15	V
Control Current	open collector/drain		1	2	mA
"P" suffix:					
Positive Logic, ON state	ON = Pin open or external voltage	5		15	V
Positive Logic, OFF state	OFF = Ground pin or external voltage	0		0.8	V
Control Current	open collector/drain		1	2	mA
Base Plate	"B" suffix				

FUNCTIONAL SPECIFICATIONS, UWE-5/20-Q48-C (CONT.)

OUTPUT					
Total Output Power		0	100	101	W
Voltage					
Nominal Output Voltage	No trim	4.95	5	5.05	Vdc
Settling Accuracy	At 50% load	-1		1	% of Vset.
Output Voltage Range	User-adjustable (see trim formulas)	-10		10	% of Vnom.
Overvoltage Protection	Via magnetic feedback		6.5	7	Vdc
Current					
Output Current Range		0	20	20	A
Minimum Load	No minimum load				
Current Limit Inception	98% of Vnom., after warmup	23	27	32	A
Short Circuit					
Short Circuit Current	Hiccup technique, autorecovery within ±1% of Vout		1.5	2.5	A
Short Circuit Duration (remove short for recovery)	Output shorted to ground, no damage		Continuous		
Short circuit protection method	Hiccup current limiting				
Regulation					
Line Regulation	Vin=min. to max., Vout=nom., nom load		±0.1		% of Vout
Load Regulation	Iout=min. to max		±0.2		% of Vout
Ripple and Noise ②	5 Hz- 20 MHz BW		75	110	mV pk-pk
Temperature Coefficient	At all outputs		0.02		% of Vout./°C
Maximum Capacitive Loading	Low ESR	0		10,000	µF
MECHANICAL (THROUGH HOLE MODELS)					
Outline Dimensions			2.3x.9x.39		Inches
(Please refer to outline drawing)	LxWxH		58.42x22.86x9.91		mm
Weight (without baseplate)			0.7		Ounces
			20		Grams
Weight (with baseplate)			12.9		Ounces
			36.5		Grams
Through Hole Pin Diameter	Diameter of pins standard		0.062 & 0.04		Inches
			1.575 & 1.016		mm
Through Hole Pin Material			Copper alloy		
TH Pin Plating Metal and Thickness	Nickel subplate		50		µ-inches
	Gold overplate		5		µ-inches
Baseplate Material			Aluminum		
ENVIRONMENTAL					
Operating Ambient Temperature Range	See derating	-40		85	°C
Storage Temperature	Vin = Zero (no power)	-55		125	°C
Operating Base Plate Temp	No derating required	-40		105	
Thermal Protection/Shutdown	Measured at hotspot	135	140	150	°C
Electromagnetic Interference	External filter is required				
Conducted, EN55022/CISPR22			B		Class
Radiated, EN55022/CISPR22			B		Class
RoHS rating			RoHS-6		

Notes

① Unless otherwise noted, all specifications are at nominal input voltage, nominal output voltage and full load.
General conditions are +25° Celsius ambient temperature, near sea level altitude, airflow of 300lfm for extended operation time.
All models are tested and specified with external parallel 1 µF and 10 µF output capacitors.
A 33µF external input capacitor is used. All capacitors are low-ESR types wired close to the converter. These capacitors are necessary for our test equipment and may not be needed in the user's application.

② Input (back) ripple current is tested and specified over 5 Hz to 20 MHz bandwidth. Input filtering is Cbus=220 µF, Cin=33 µF and Lbus=12 µH.

③ All models are stable and regulate to specification under no load.

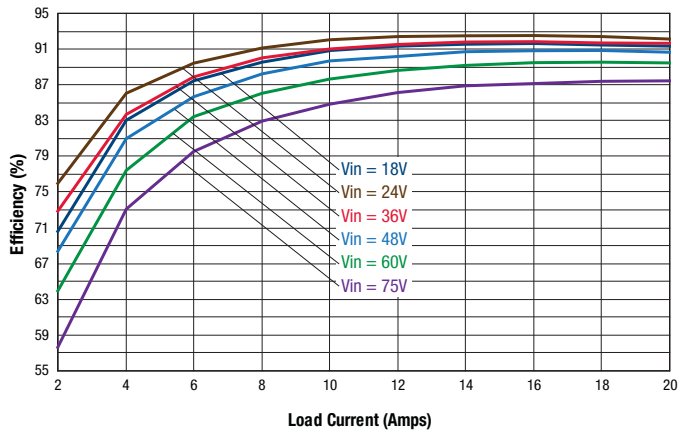
④ The Remote On/Off Control is referred to -Vin. For external transistor control, use open collector logic or equivalent.

⑤ NOTICE—Please use only this customer data sheet as product documentation when laying out your printed circuit boards and applying this product into your application. Do NOT use other materials as official documentation such as advertisements, product announcements, or website graphics.
We strive to have all technical data in this customer data sheet highly accurate and complete. This customer data sheet is revision-controlled and dated. The latest customer data sheet revision is normally on our website (www.murata-ps.com) for products which are fully released to Manufacturing. Please be especially careful using any data sheets labeled "Preliminary" since data may change without notice. Please be aware of small details that may affect your application and PC board layouts. Study the Mechanical Outline drawings, Input/Output Connection table and all footnotes very carefully. Please contact Murata Power Solutions if you have any questions.

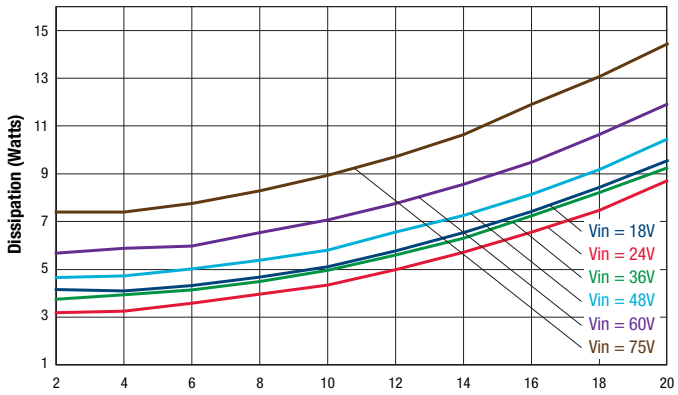
⑥ If reverse polarity is accidentally applied to the input, to ensure reverse input protection, always connect an external input fuse in series with the +VIN input. Use approximately twice the full input current rating with nominal input voltage.

PERFORMANCE DATA, UWE-5/20-Q48-C

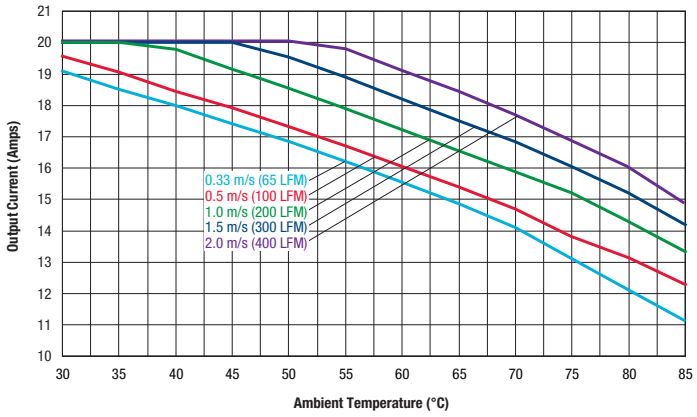
Efficiency vs. Line Voltage and Load Current @ 25°C



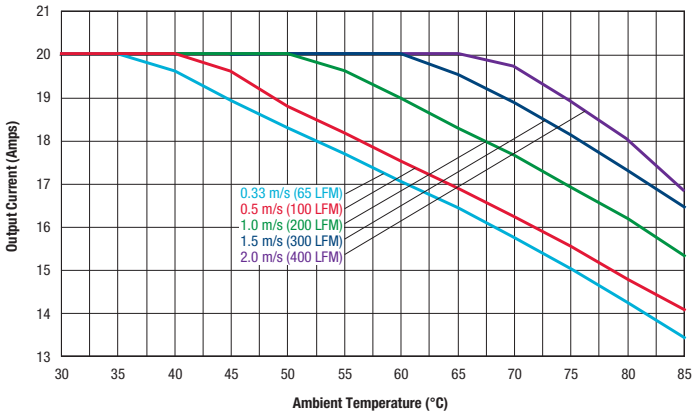
Power Dissipation vs. Line and Load



Maximum Current Temperature Derating @sea level (VIN = 48V, air flow from Pin 1 to Pin 3, no baseplate)

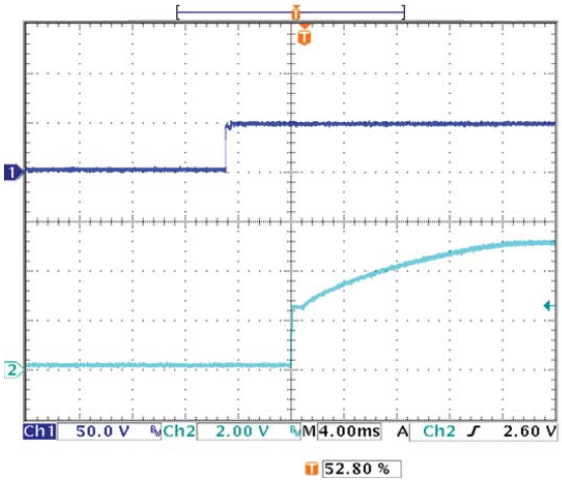


Maximum Current Temperature Derating @sea level (VIN = 48V, air flow from Pin 1 to Pin 3, with baseplate)

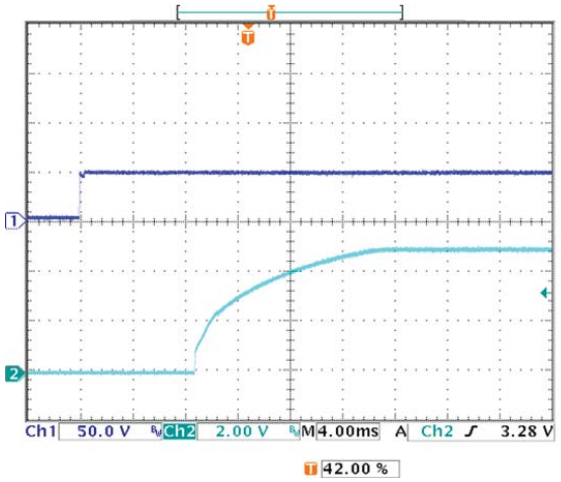


PERFORMANCE DATA, UWE-5/20-Q48-C

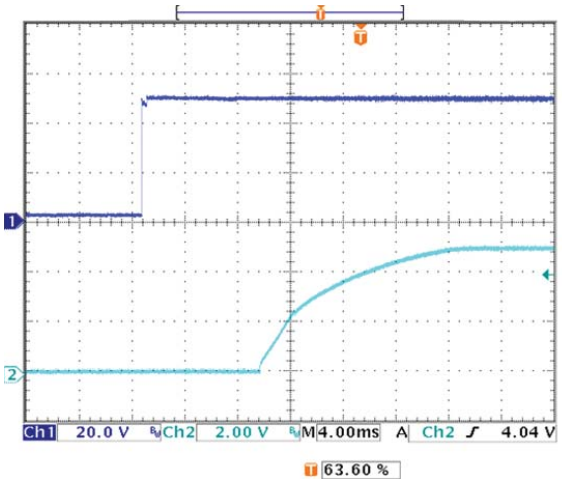
Startup Delay (Vin=48V, Iout=0A, Cout=0, Ta=+25°C) Trace1=Vin, Trace2=Vout.



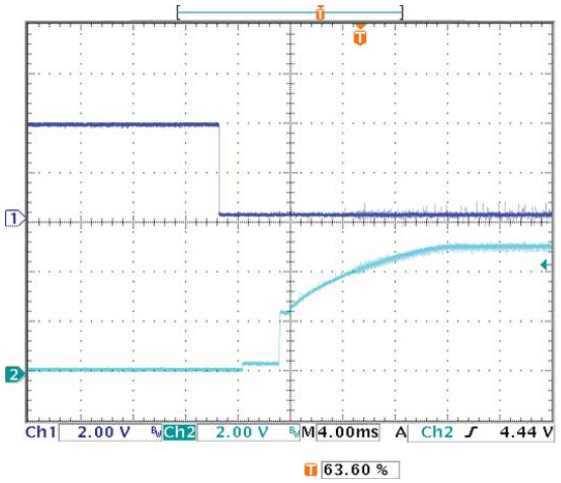
Startup Delay (Vin=48V, Iout=20A, Cout=0, Ta=+25°C) Trace1=Vin, Trace2=Vout.



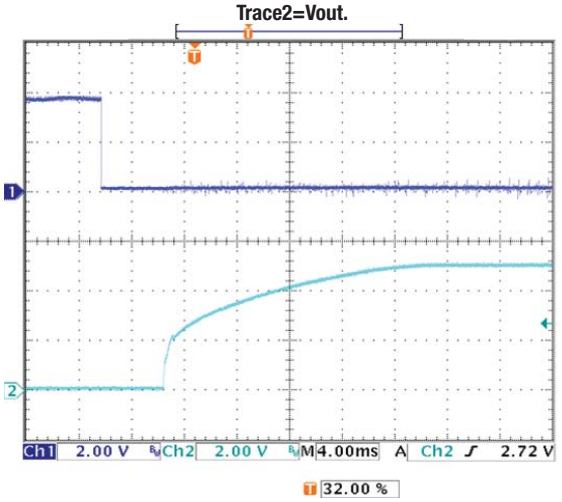
Startup Delay (Vin=48V, Iout=20A, Cout=10000µF, Ta=+25°C) Trace1=Vin, Trace2=Vout.



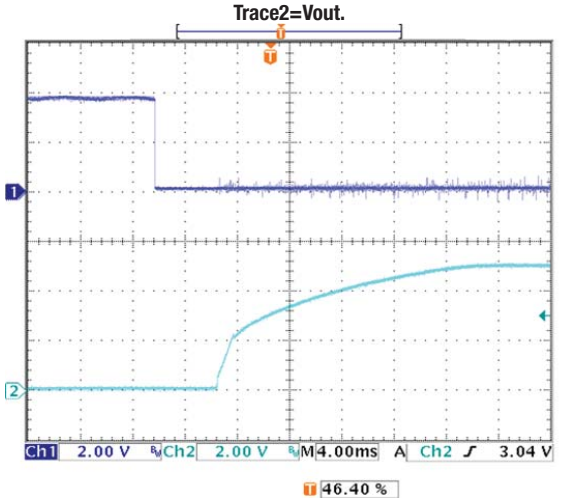
On/Off Enable Delay (Vin=48V, Iout=0A, Cout=0, Ta=+25°C) Trace1=Enable, Trace2=Vout.



On/Off Enable Delay (Vin=48V, Iout=20A, Cout=0, Ta=+25°C) Trace1=Enable, Trace2=Vout.

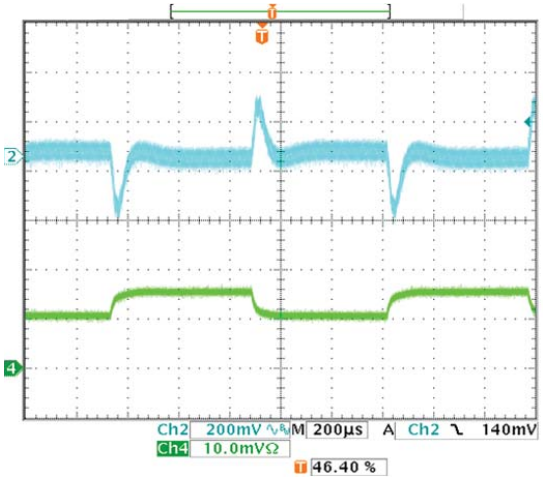


On/Off Enable Delay (Vin=48V, Iout=20A, Cout=10000µF, Ta=+25°C) Trace1=Enable, Trace2=Vout.

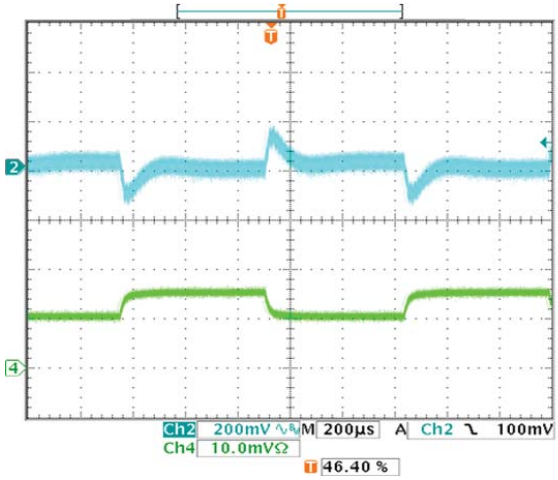


PERFORMANCE DATA, UWE-5/20-Q48-C

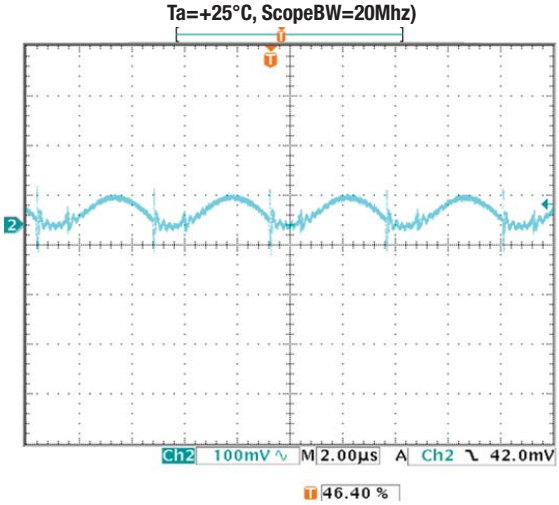
Stepload Transient Response (Vin=48V, Iout=50-75-50% of Iout, Cload= 1µF ll 10µF , Slew rate: 10A/uS at Ta=+25°C)



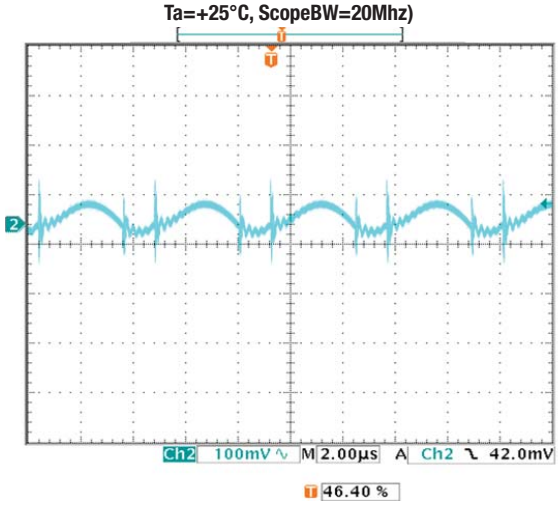
Stepload Transient Response (Vin=48V, Iout=50-75-50% of Iout, Cload= 1µF ll 10µF ll10000µF , Slew rate: 10A/uS at Ta=+25°C)



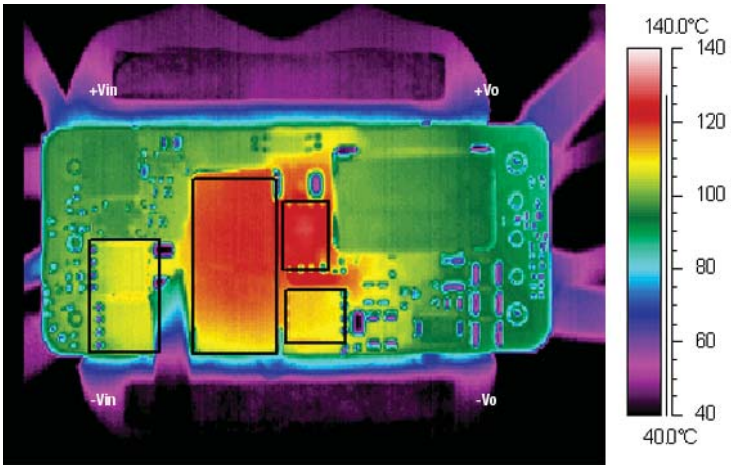
Output Ripple and Noise (Vin=48V, Vout=nom, Iout=0A, Cout=1F ll 10µF, Ta=+25°C, ScopeBW=20Mhz)



Output Ripple and Noise (Vin=48V, Vout=nom, Iout=20A, Cout=1F ll 10µF, Ta=+25°C, ScopeBW=20Mhz)



Thermal image with hot spot at 17A current with 25°C ambient temperature. Natural convection is used with no forced airflow. Identifiable and recommended maximum value to be verifi ed in application. Vin=48V, Q14 is the hot spot.



FUNCTIONAL SPECIFICATIONS, UWE-12/10-Q48

ABSOLUTE MAXIMUM RATINGS	CONDITIONS AND COMMENTS ①	MINIMUM	TYPICAL/NOMINAL	MAXIMUM	UNITS
Input Voltage, Continuous	Full power operation			80	Vdc
Input Voltage, Transient	Operating or non-operating, 100 mS max. duration			100	Vdc
Isolation Voltage	Input to output			2250	Vdc
Input Reverse Polarity	None, install external fuse		None		Vdc
On/Off Remote Control	Power on or off, referred to -Vin	0		15	Vdc
Output Power		0		121.2	W
Output Current	Current-limited, no damage, short-circuit protected	0		10	A
Storage Temperature Range	Vin = Zero (no power)	-55		125	°C
Absolute maximums are stress ratings. Exposure of devices to greater than 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 or recommended.					
INPUT	**CONDITIONS AND COMMENTS ① ③**				
Operating voltage range		18	48	75	Vdc
Recommended External Fuse	Fast blow			15 ⑥	A
Start-up threshold, Turn On	Rising input voltage	17	17.5	17.9	Vdc
Undervoltage shutdown, Turn Off	Falling input voltage	16	16.45	17.5	Vdc
Turn-On/Turn-Off Hysteresis		0.81	0.86		Vdc
Overvoltage shutdown			NA		Vdc
Reverse Polarity Protection	None, install external fuse		None		Vdc
Internal Filter Type			Pi-type		
Input current					
Full Load Conditions	Vin = nominal		2.732	2.806	A
Low Line	Vin = minimum		7.286	7.481	A
Inrush Transient			0.1		A^2-Sec.
Output in Short Circuit			100	150	mA
No Load Input Current (Iout @ min)	Iout = minimum, unit=ON		110	150	mA
Shut-Down Mode Input Current			4	8	mA
Reflected (back) ripple current ②	no filtering		400	500	mA, P-P
Reflected (back) ripple current ②	Measured at input with specified filter		40	50	mA, P-P
Pre-biased startup	Monotonic				
GENERAL AND SAFETY					
Efficiency	Vin=24V, full load	90.5	92.5		%
	Vin=min.	90	91.5		%
	Vin=48V, full load	90	91.5		%
Isolation					
Isolation Voltage, input to output	No baseplate	2250			Vdc
Isolation Voltage, input to output	With baseplate	2250			Vdc
Isolation Voltage, input to baseplate	With baseplate	1500			Vdc
Isolation Voltage, output to baseplate	With baseplate	500			Vdc
Insulation Safety Rating			basic		
Isolation Resistance			100		MΩ
Isolation Capacitance			1000		pF
Safety	Certified to UL-60950-1, CSA-C22.2 No.60950-1, IEC/EN60950-1, 2nd edition		Yes		
Calculated MTBF	Per Telcordia SR332, issue 1, class 3, ground fixed, Tambient=+25°C		3.1		Hours x 10^6
DYNAMIC CHARACTERISTICS					
Fixed Switching Frequency		200	220	240	KHz
Startup Time	Power on to Vout regulated		30	40	mS
Startup Time	Remote ON to Vout regulated		20	30	mS
Dynamic Load Response	50-75-50% load step, settling time to within ±2% of Vout		100	200	µSec
Dynamic Load Peak Deviation	same as above		±650		mV
FEATURES AND OPTIONS					
Remote On/Off Control ④					
"N" suffix:					
Negative Logic, ON state	ON = Pin grounded or external voltage	1		1	V
Negative Logic, OFF state	OFF = Pin open or external voltage	3.5		15	V
Control Current	open collector/drain		1	2	mA
"P" suffix:					
Positive Logic, ON state	ON = Pin open or external voltage	3.5		15	V
Positive Logic, OFF state	OFF = Ground pin or external voltage	0		0.8	V
Control Current	open collector/drain		1	2	mA
Base Plate	"B" suffix				

FUNCTIONAL SPECIFICATIONS, UWE-12/10-Q48 (CONT.)

OUTPUT					
Total Output Power		0	120	121.2	W
Voltage					
Nominal Output Voltage	No trim	11.88	12	12.12	Vdc
Setting Accuracy	At 50% load	-1		1	% of Vset.
Output Voltage Range	User-adjustable	-10		10	% of Vnom.
Overvoltage Protection	Via magnetic feedback		15	16	Vdc
Current					
Output Current Range		0	10	10	A
Minimum Load	No minimum load				
Current Limit Inception	98% of Vnom., after warmup	11.5	12.5	14	A
Short Circuit					
Short Circuit Current	Hiccup technique, autorecovery within ±1% of Vout		1	2	A
Short Circuit Duration (remove short for recovery)	Output shorted to ground, no damage		Continuous		
Short circuit protection method	Hiccup current limiting				
Regulation					
Line Regulation	Vin=min. to max., Vout=nom., nom load		±0.15		% of Vout
Load Regulation	Iout=min. to max		±0.075		% of Vout
Ripple and Noise ②	5 Hz- 20 MHz BW		115	200	mV pk-pk
Temperature Coefficient	At all outputs		0.02		% of Vout./°C
Maximum Capacitive Loading	Low ESR	0	4700		µF
MECHANICAL (THROUGH HOLE MODELS)					
Outline Dimensions			2.3x.9x.39		Inches
(Please refer to outline drawing)	LxWxH		58.42x22.86x9.91		mm
Weight (without baseplate)			0.7		Ounces
			20		Grams
Weight (with baseplate)			12.9		Ounces
			36.5		Grams
Through Hole Pin Diameter	Diameter of pins standard		0.062 & 0.04		Inches
			1.575 & 1.016		mm
Through Hole Pin Material			Copper alloy		
TH Pin Plating Metal and Thickness	Nickel subplate		50		µ-inches
	Gold overplate		5		µ-inches
Baseplate Material			Aluminum		
ENVIRONMENTAL					
Operating Ambient Temperature Range	See derating curves	-40		85	°C
Storage Temperature	Vin = Zero (no power)	-55		125	°C
Operating Base Plate Temp	No derating required	-40		100	
Thermal Protection/Shutdown	Measured at hotspot	135	140	150	°C
Electromagnetic Interference	External filter is required				
Conducted, EN55022/CISPR22			B		Class
Radiated, EN55022/CISPR22			B		Class
RoHS rating			RoHS-6		

Notes

① Unless otherwise noted, all specifications are at nominal input voltage, nominal output voltage and full load.
General conditions are +25° Celsius ambient temperature, near sea level altitude, airflow rate of 300lfm for extended operation time.
All models are tested and specified with external parallel 1 µF and 10 µF output capacitors.
A 33µF external input capacitor is used. All capacitors are low-ESR types wired close to the converter. These capacitors are necessary for our test equipment and may not be needed in the user's application.

② Input (back) ripple current is tested and specified over 5 Hz to 20 MHz bandwidth. Input filtering is Cbus=220 µF, Cin=33 µF and Lbus=12 µH.

③ All models are stable and regulate to specification under no load.

④ The Remote On/Off Control is referred to -Vin. For external transistor control, use open collector logic or equivalent.

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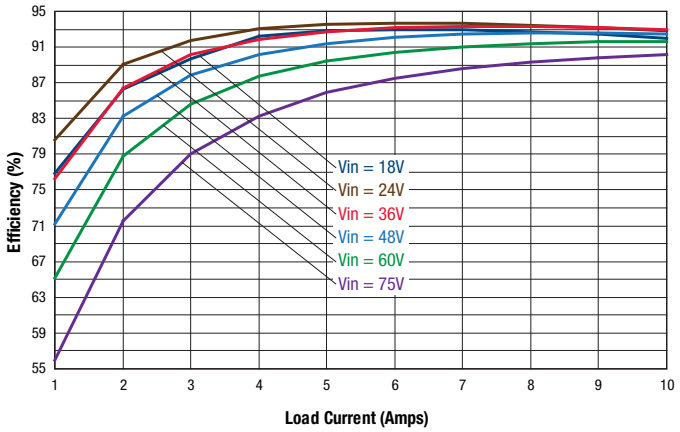
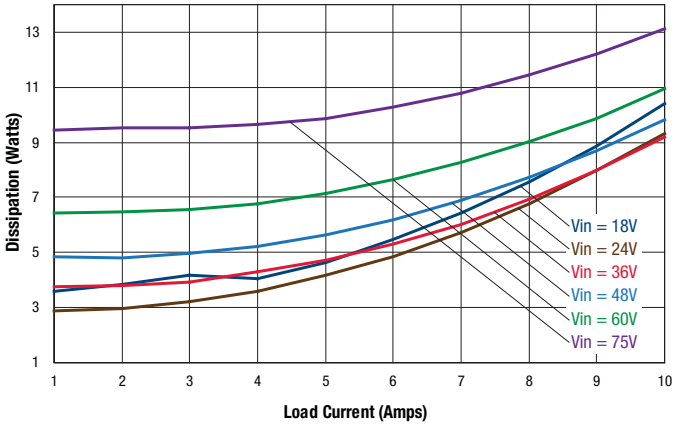
⑥ If reverse polarity is accidentally applied to the input, to ensure reverse input protection, always connect an external input fuse in series with the +VIN input. Use approximately twice the full input current rating with nominal input voltage.

PERFORMANCE DATA, UWE-12/10-Q48

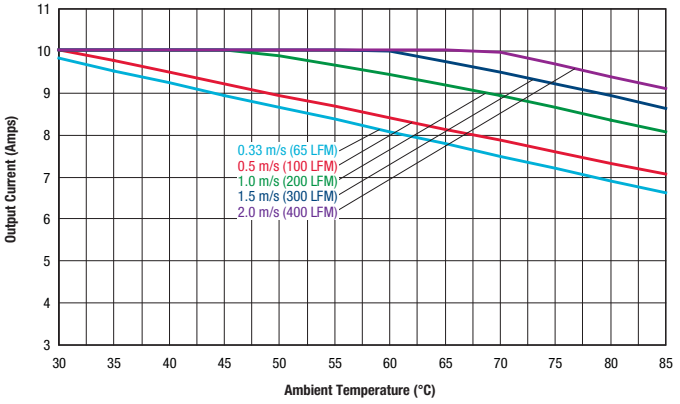
Efficiency vs. Line Voltage and Load Current @ 25°C



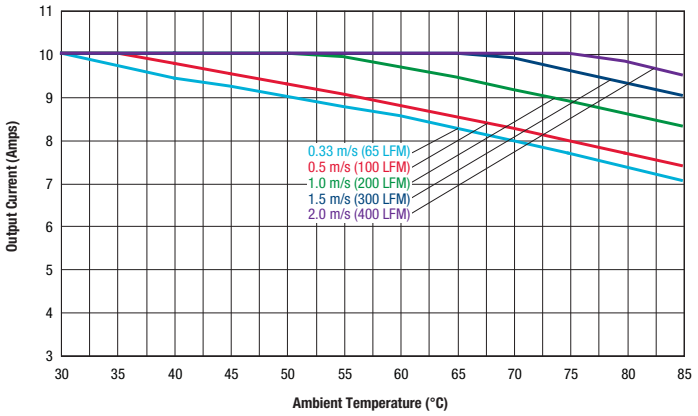
Power Dissipation vs. Line and Load



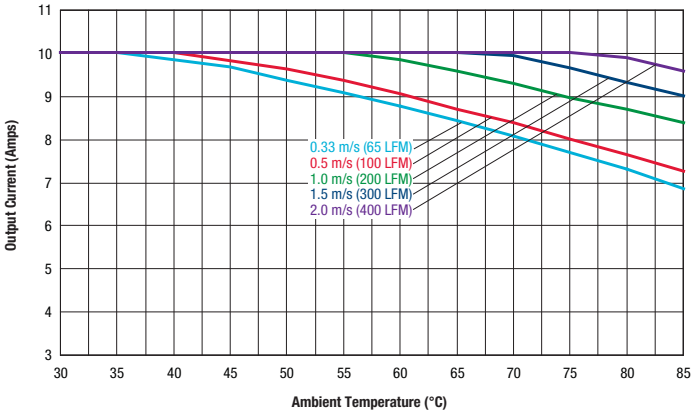
Maximum Current Temperature Derating @ sea level (VIN = 24V, air flow from Pin 1 to Pin 3, no baseplate)



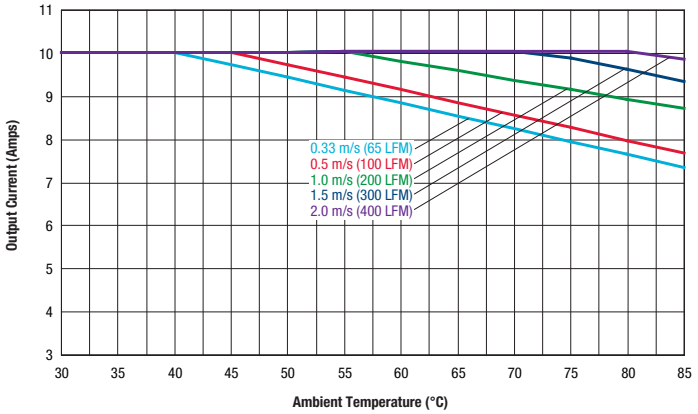
Maximum Current Temperature Derating @sea level (VIN = 24V, air flow from Pin 1 to Pin 3, with baseplate)



Maximum Current Temperature Derating @sea level (VIN = 48V, air flow from Pin 1 to Pin 3, no baseplate)

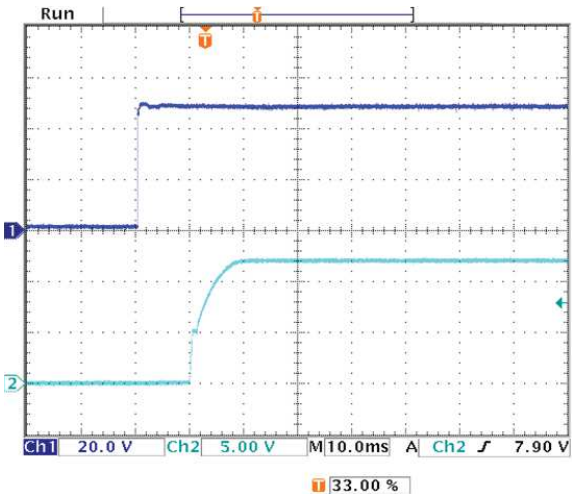


Maximum Current Temperature Derating @sea level (VIN = 48V, air flow from Pin 1 to Pin 3, with baseplate)

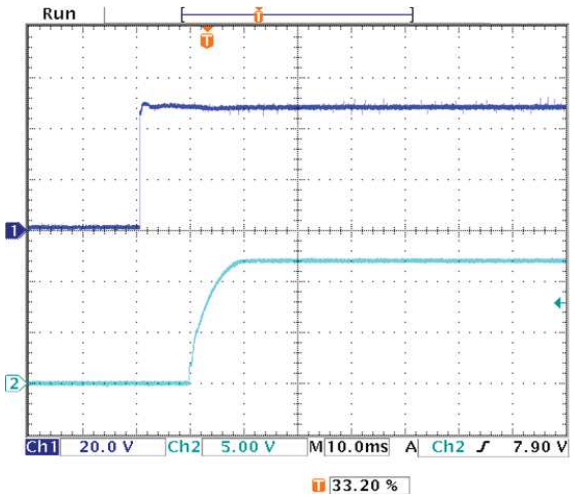


PERFORMANCE DATA, UWE-12/10-Q48

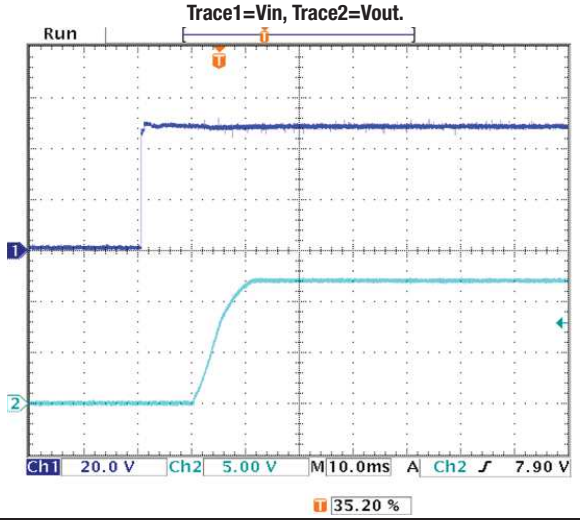
Startup Delay (Vin=48V, Iout=0A, Cout=0, Ta=+25°C) Trace1=Vin, Trace2=Vout.



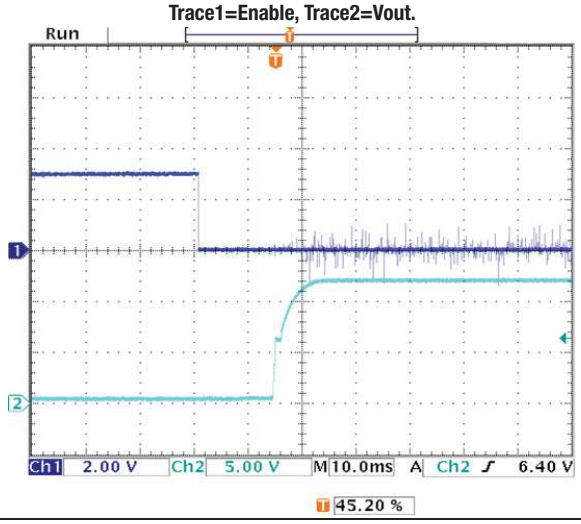
Startup Delay (Vin=48V, Iout=10A, Cout=0, Ta=+25°C) Trace1=Vin, Trace2=Vout.



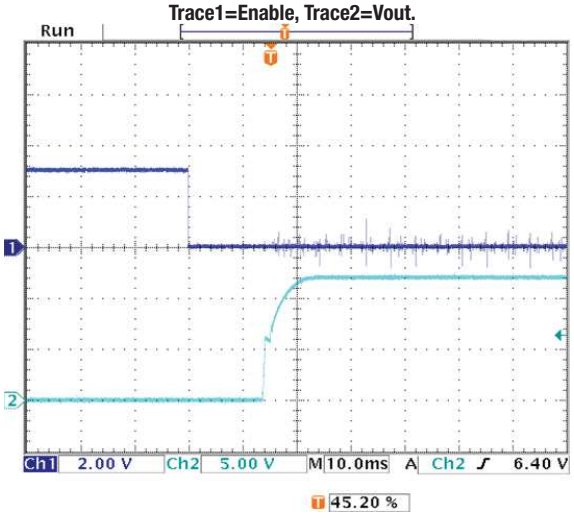
Startup Delay (Vin=48V, Iout=10A, Cout=4700µF, Ta=+25°C) Trace1=Vin, Trace2=Vout.



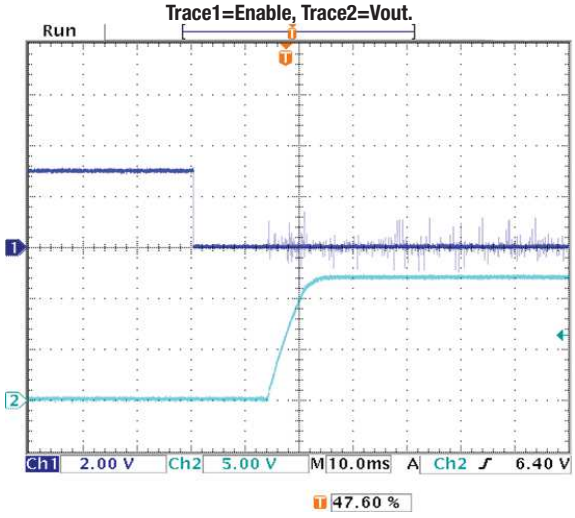
On/Off Enable Delay (Vin=48V, Iout=0A, Cout=0, Ta=+25°C) Trace1=Enable, Trace2=Vout.



On/Off Enable Delay (Vin=48V, Iout=10A, Cout=0, Ta=+25°C) Trace1=Enable, Trace2=Vout.

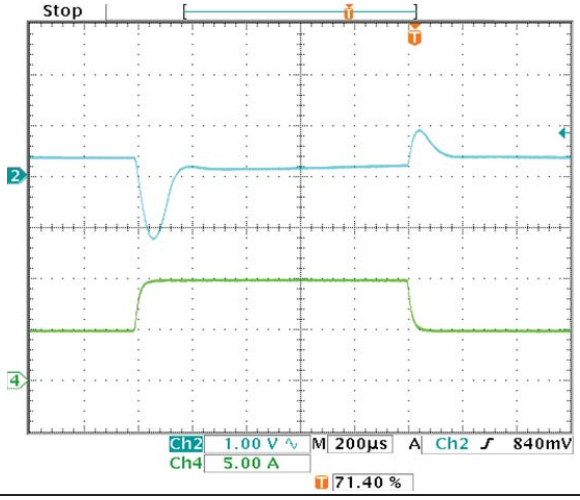


On/Off Enable Delay (Vin=48V, Iout=10A, Cout=4700µF, Ta=+25°C) Trace1=Enable, Trace2=Vout.

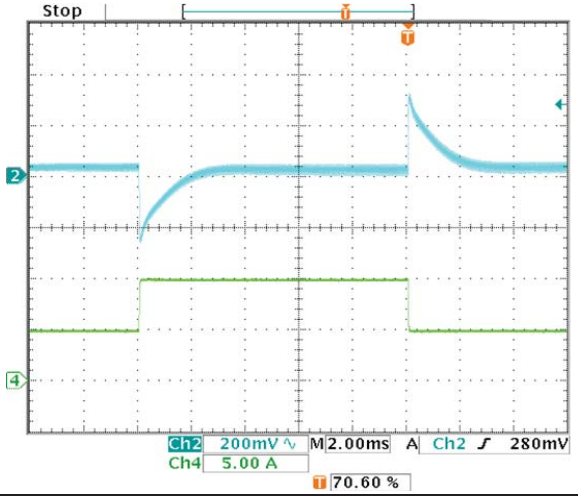


PERFORMANCE DATA, UWE-12/10-Q48

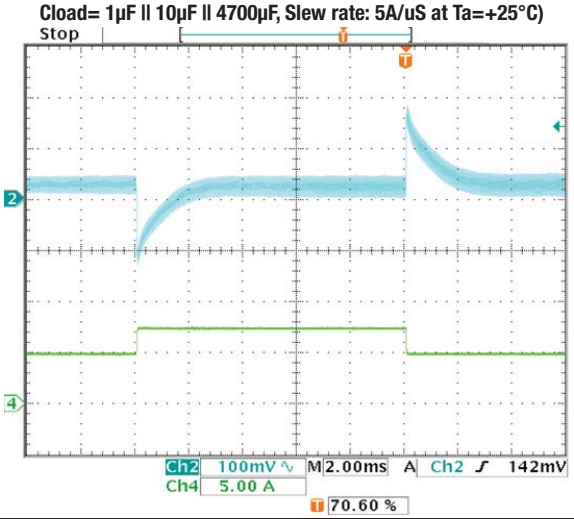
Stepload Transient Response (Vin=48V, Iout=50-100-50% of Iout, Cload= 1µF ll 10µF, Slew rate: 5A/uS at Ta=+25°C)



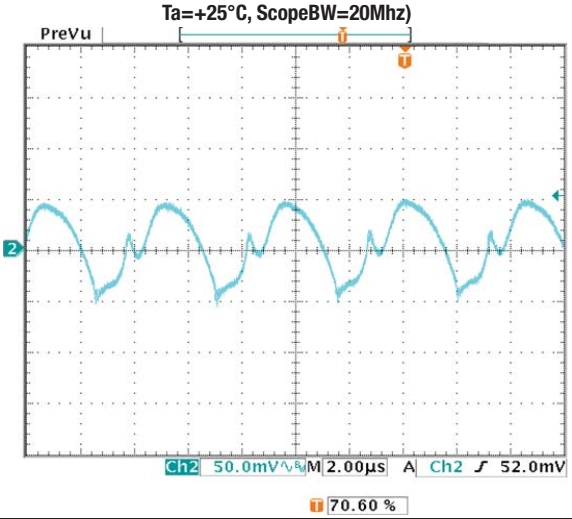
Stepload Transient Response (Vin=48V, Iout=50-100-50% of Iout, Cload= 1µF ll 10µF ll 4700µF, Slew rate: 5A/uS at Ta=+25°C)



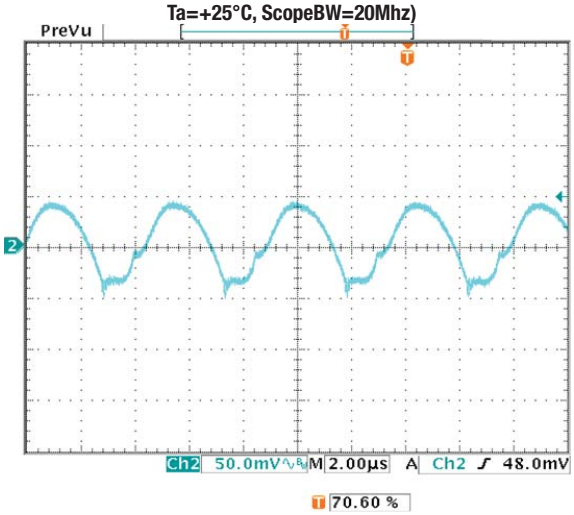
Stepload Transient Response (Vin=48V, Iout=50-75-50% of Iout, Cload= 1µF ll 10µF ll 4700µF, Slew rate: 5A/uS at Ta=+25°C)



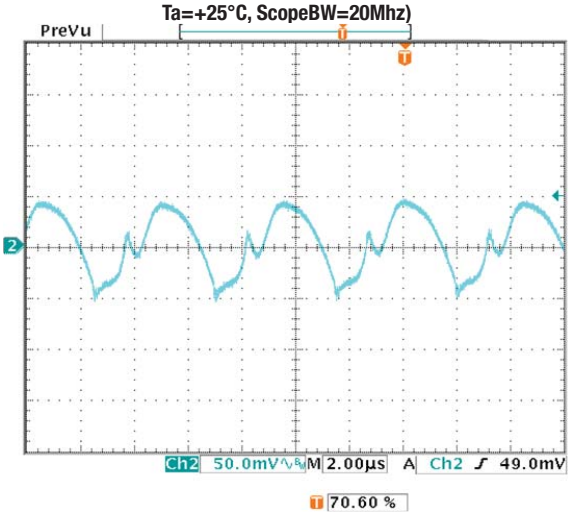
Output Ripple and Noise (Vin=48V, Vout=nom, Iout=0A, Cout=1F ll 10µF, Ta=+25°C, ScopeBW=20Mhz)



Output Ripple and Noise (Vin=48V, Vout=nom, Iout=10A, Cout=1F ll 10µF, Ta=+25°C, ScopeBW=20Mhz)

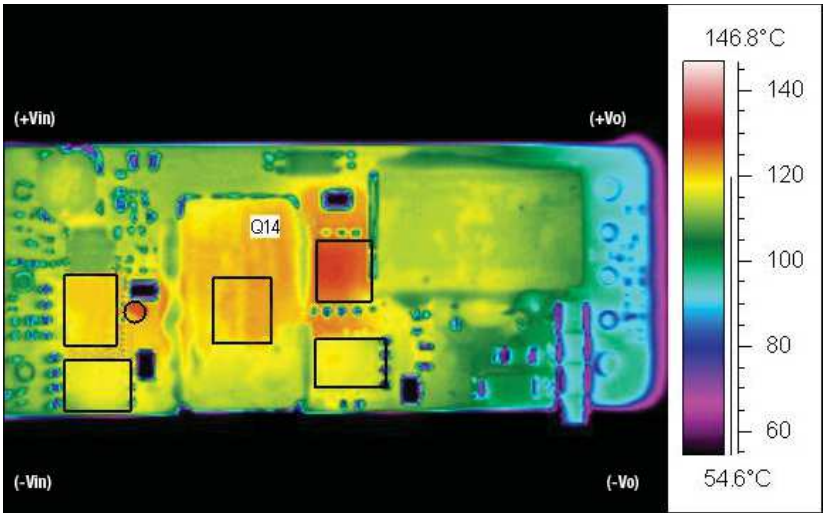


Output Ripple and Noise (Vin=48V, Vout=nom, Iout=10A, Cout=1F ll 10µF ll 4700µF, Ta=+25°C, ScopeBW=20Mhz)



PERFORMANCE DATA, UWE-12/10-Q48

Thermal image with hot spot at 8.24A current with 25°C ambient temperature. Natural convection is used with no forced airflow. Identifiable and recommended maximum value to be verified in application. Vin=48V, Q14 is the hot spot.



FUNCTIONAL SPECIFICATIONS, UWE-12/10-Q12

ABSOLUTE MAXIMUM RATINGS	CONDITIONS AND COMMENTS ①	MINIMUM	TYPICAL/NOMINAL	MAXIMUM	UNITS
Input Voltage, Continuous	Full power operation			36	Vdc
Input Voltage, Transient	Operating or non-operating, 100 mS max. duration			50	Vdc
Isolation Voltage	Input to output				Vdc
Input Reverse Polarity	None, install external fuse		None		Vdc
On/Off Remote Control	Power on or off, referred to -Vin	0		15	Vdc
Output Power		0		121.2	W
Output Current	Current-limited, no damage, short-circuit protected	0		10	A
Storage Temperature Range	Vin = Zero (no power)	-55		125	°C
Absolute maximums are stress ratings. Exposure of devices to greater than 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 or recommended.					
INPUT	**CONDITIONS AND COMMENTS ① ③**				
Operating voltage range		9	12	36	Vdc
Recommended External Fuse	Fast blow			20	A
Start-up threshold, Turn On	Rising input voltage	9.5	10	10.5	Vdc
Undervoltage shutdown, Turn Off	Falling input voltage	7.5	8	8.9	Vdc
Turn-On/Turn-Off Hysteresis		1	2		Vdc
Overvoltage shutdown			NA		Vdc
Reverse Polarity Protection	None, install external fuse		None		Vdc
Internal Filter Type			Pi-type		
Input current					
Full Load Conditions	Vin = nominal		10.95	11.29	A
Low Line	Vin = minimum		14.73	15.13	A
Inrush Transient			0.1		A^2-Sec.
Output in Short Circuit			100	150	mA
No Load Input Current (Iout @ min)	Iout = minimum, unit=ON		260	340	mA
Shut-Down Mode Input Current			5	8	mA
Reflected (back) ripple current ②	no filtering		200	250	mA, P-P
Reflected (back) ripple current ②	Measured at input with specified filter		20	30	mA, P-P
Pre-biased startup	Monotonic				
GENERAL AND SAFETY					
Efficiency	Vin=12V, full load	89.5	91.3		%
	Vin=min.	89	90.5		%
	Vin=24V, full load	89.5	91.4		%
Isolation					
Isolation Voltage, input to output	No baseplate			2250	Vdc
Isolation Voltage, input to output	With baseplate			2250	Vdc
Isolation Voltage, input to baseplate	With baseplate			1500	Vdc
Isolation Voltage, output to baseplate	With baseplate			750	Vdc
Insulation Safety Rating			basic		
Isolation Resistance			100		MΩ
Isolation Capacitance			1000		pF
Safety	Certified to UL-60950-1, CSA-C22.2 No.60950-1, IEC/EN60950-1, 2nd edition		Yes		
Calculated MTBF	Per Telcordia SR332, issue 1, class 3, ground fixed, Tambient=+25°C		TBC		Hours x 10^6
DYNAMIC CHARACTERISTICS					
Fixed Switching Frequency		200	220	240	KHz
Startup Time	Power on to Vout regulated		25	40	mS
Startup Time	Remote ON to Vout regulated		25	40	mS
Dynamic Load Response	50-75-50% load step, settling time to within ±2% of Vout		50	100	µSec
Dynamic Load Peak Deviation	same as above		±110	±200	mV
FEATURES AND OPTIONS					
Remote On/Off Control ④					
"N" suffix:					
Negative Logic, ON state	ON = Pin grounded or external voltage	0		1	V
Negative Logic, OFF state	OFF = Pin open or external voltage	3.5		15	V
Control Current	open collector/drain		1	2	mA
"P" suffix:					
Positive Logic, ON state	ON = Pin open or external voltage	3.5		15	V
Positive Logic, OFF state	OFF = Ground pin or external voltage	0		0.8	V
Control Current	open collector/drain		1	2	mA
Base Plate	"B" suffix				

FUNCTIONAL SPECIFICATIONS, UWE-12/10-Q12 (CONT.)

OUTPUT					
Total Output Power		0	120	121.2	W
Voltage					
Nominal Output Voltage	No trim	11.88	12	12.12	Vdc
Setting Accuracy	At 50% load	-1		1	% of Vset.
Output Voltage Range	User-adjustable	-10		10	% of Vnom.
Overvoltage Protection	Via magnetic feedback		15	16	Vdc
Current					
Output Current Range		0		10	A
Minimum Load	No minimum load				
Current Limit Inception	98% of Vnom., after warmup	11.5	13.5	15.5	A
Short Circuit					
Short Circuit Current	Hiccup technique, autorecovery within ±1% of Vout		1	2	A
Short Circuit Duration (remove short for recovery)	Output shorted to ground, no damage		Continuous		
Short circuit protection method	Hiccup current limiting				
Regulation					
Line Regulation	Vin=min. to max., Vout=nom., nom load		±0.15		% of Vout
Load Regulation	Iout=min. to max		±0.075		% of Vout
Ripple and Noise ②	5 Hz- 20 MHz BW		115	200	mV pk-pk
Temperature Coefficient	At all outputs		0.02		% of Vout./°C
Maximum Capacitive Loading	Low ESR	0	4700		µF
MECHANICAL (THROUGH HOLE MODELS)					
Outline Dimensions			2.3x.9x0.34		Inches
(Please refer to outline drawing)	LxWxH		58.42x22.86x8.64		mm
Weight (without baseplate)			0.7		Ounces
			20		Grams
Weight (with baseplate)			12.9		Ounces
			36.5		Grams
Through Hole Pin Diameter	Diameter of pins standard		0.062 & 0.04		Inches
			1.575 & 1.016		mm
Through Hole Pin Material			Copper alloy		
TH Pin Plating Metal and Thickness	Nickel subplate		50		µ-inches
	Gold overplate		5		µ-inches
Baseplate Material			Aluminum		
ENVIRONMENTAL					
Operating Ambient Temperature Range	See derating curves	-40		85	°C
Storage Temperature	Vin = Zero (no power)	-55		125	°C
Operating Base Plate Temp	No derating required	-40		100	
Thermal Protection/Shutdown	Measured at hotspot	135	140	150	°C
Electromagnetic Interference	External filter is required				
Conducted, EN55022/CISPR22			B		Class
Radiated, EN55022/CISPR22			B		Class
RoHS rating			RoHS-6		

Notes

① Unless otherwise noted, all specifications are at nominal input voltage, nominal output voltage and full load.
General conditions are +25° Celsius ambient temperature, near sea level altitude, airflow rate of 300lfm for extended operation time.
All models are tested and specified with external parallel 1 µF and 10 µF output capacitors.
A 33µF external input capacitor is used. All capacitors are low-ESR types wired close to the converter. These capacitors are necessary for our test equipment and may not be needed in the user's application.

② Input (back) ripple current is tested and specified over 5 Hz to 20 MHz bandwidth. Input filtering is Cbus=220 µF, Cin=33 µF and Lbus=12 µH.

③ All models are stable and regulate to specification under no load.

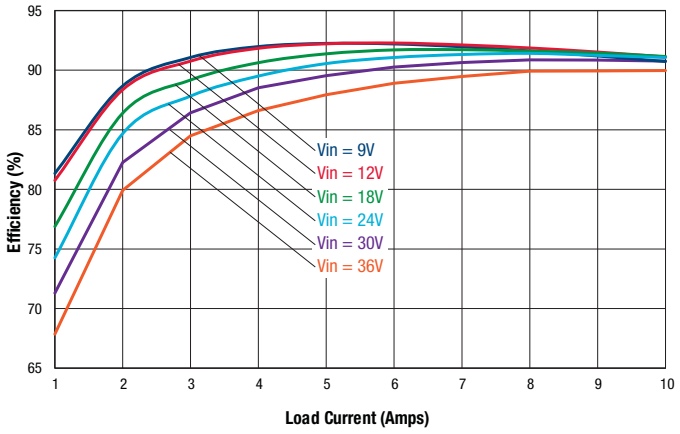
④ The Remote On/Off Control is referred to -Vin. For external transistor control, use open collector logic or equivalent.

⑤ NOTICE—Please use only this customer data sheet as product documentation when laying out your printed circuit boards and applying this product into your application. Do NOT use other materials as official documentation such as advertisements, product announcements, or website graphics.
We strive to have all technical data in this customer data sheet highly accurate and complete. This customer data sheet is revision-controlled and dated. The latest customer data sheet revision is normally on our website (www.murata-ps.com) for products which are fully released to Manufacturing. Please be especially careful using any data sheets labeled "Preliminary" since data may change without notice. Please be aware of small details that may affect your application and PC board layouts. Study the Mechanical Outline drawings, Input/Output Connection table and all footnotes very carefully. Please contact Murata Power Solutions if you have any questions.

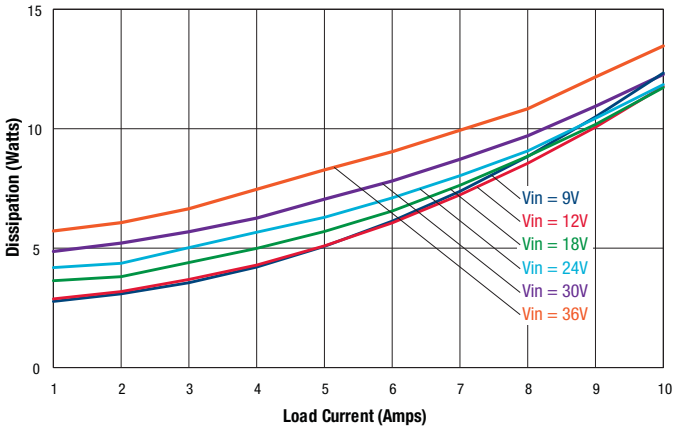
⑥ If reverse polarity is accidentally applied to the input, to ensure reverse input protection, always connect an external input fuse in series with the +VIN input. Use approximately twice the full input current rating with nominal input voltage.

PERFORMANCE DATA, UWE-12/10-Q12

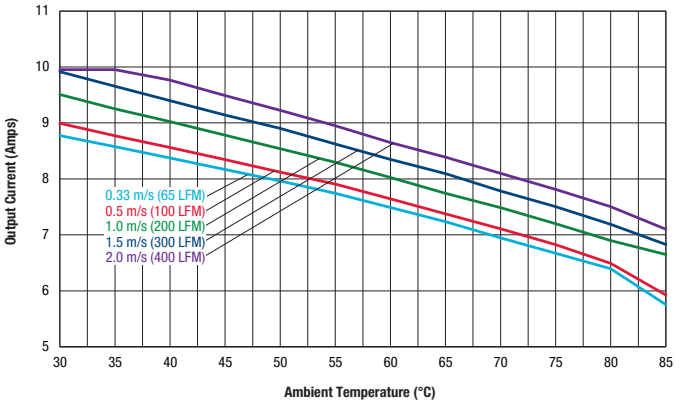
Efficiency vs. Line Voltage and Load Current @ 25°C



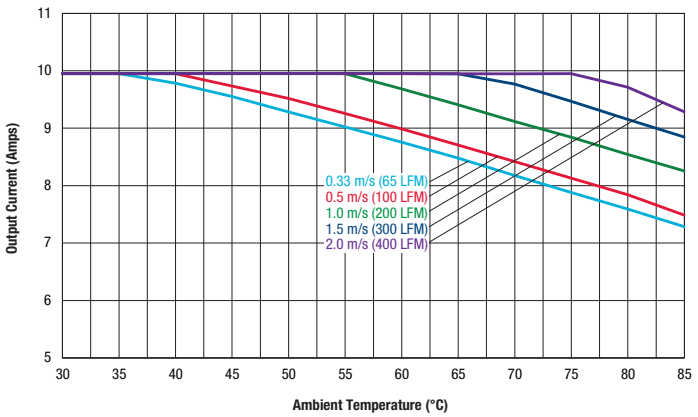
Power Dissipation vs. Line and Load



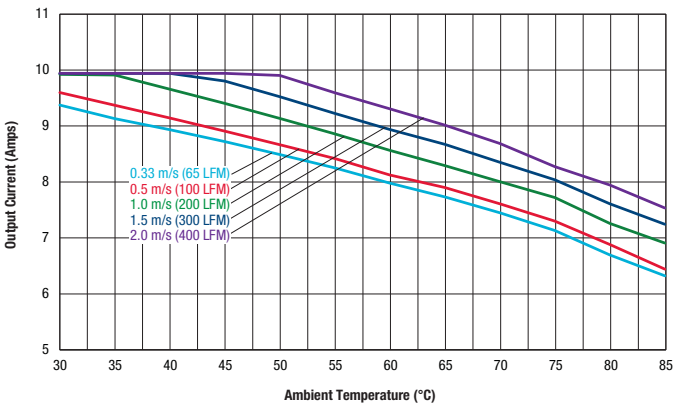
Maximum Current Temperature Derating @ sea level (VIN = 9V, air flow from Pin 1 to Pin 3, no baseplate)



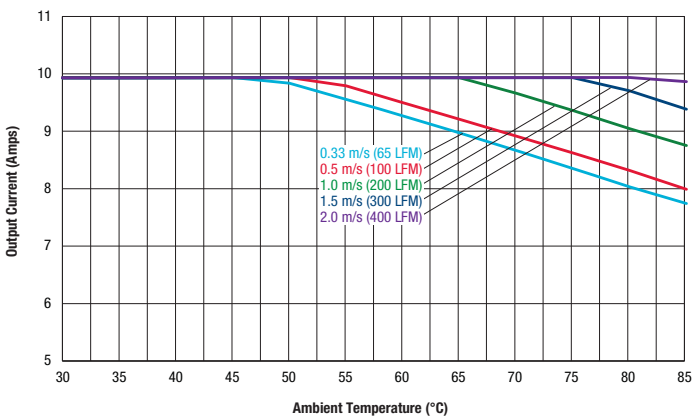
Maximum Current Temperature Derating @sea level (VIN = 9V, air flow from Pin 1 to Pin 3, with baseplate)



Maximum Current Temperature Derating @ sea level (VIN = 12V, air flow from Pin 1 to Pin 3, no baseplate)

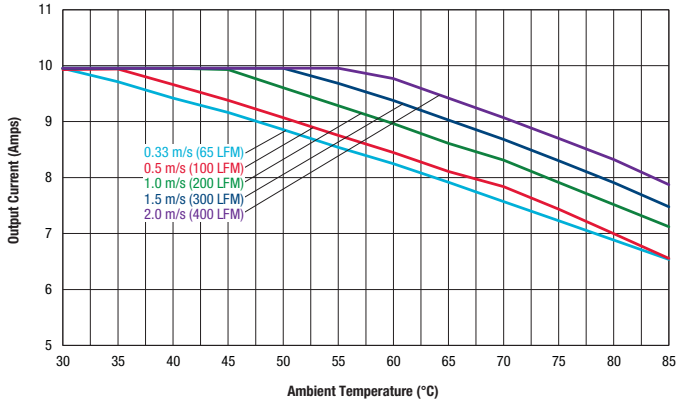


Maximum Current Temperature Derating @sea level (VIN = 12V, air flow from Pin 1 to Pin 3, with baseplate)

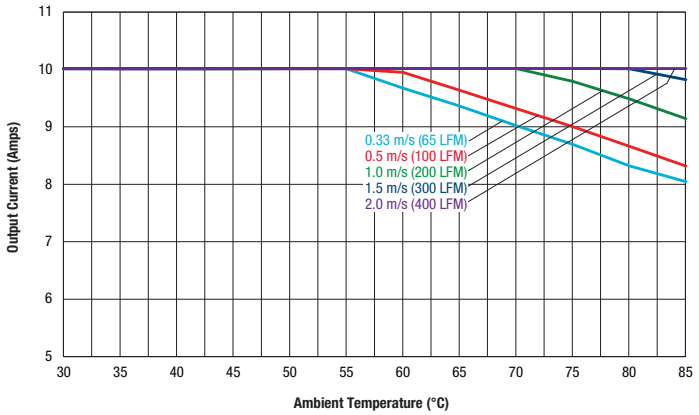


PERFORMANCE DATA, UWE-12/10-Q12

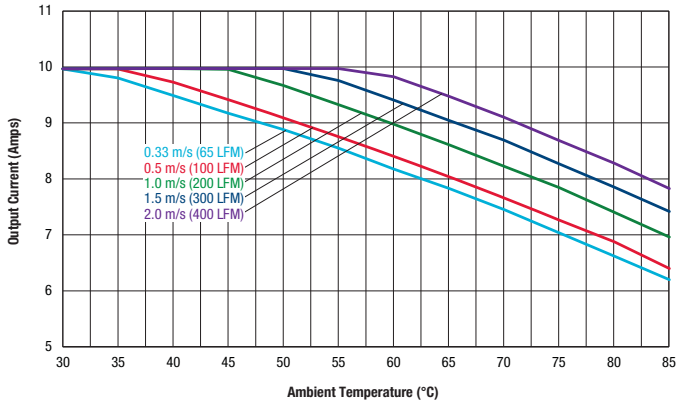
Maximum Current Temperature Derating @ sea level
(V_{IN} = 18V, air flow from Pin 1 to Pin 3, no baseplate)



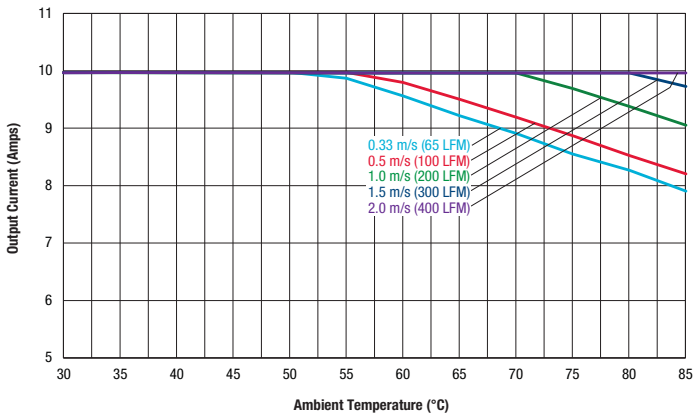
Maximum Current Temperature Derating @sea level
(V_{IN} = 18V, air flow from Pin 1 to Pin 3, with baseplate)



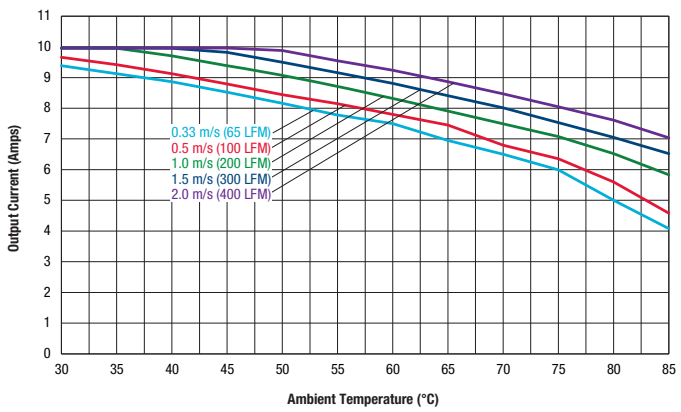
Maximum Current Temperature Derating @ sea level
(V_{IN} = 24V, air flow from Pin 1 to Pin 3, no baseplate)



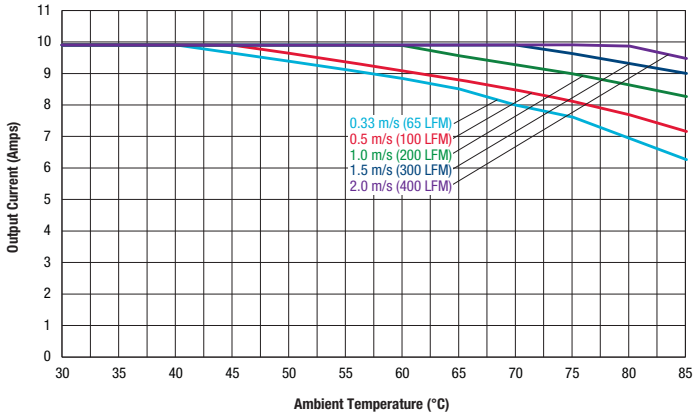
Maximum Current Temperature Derating @sea level
(V_{IN} = 24V, air flow from Pin 1 to Pin 3, with baseplate)



Maximum Current Temperature Derating @ sea level
(V_{IN} = 36V, air flow from Pin 1 to Pin 3, no baseplate)

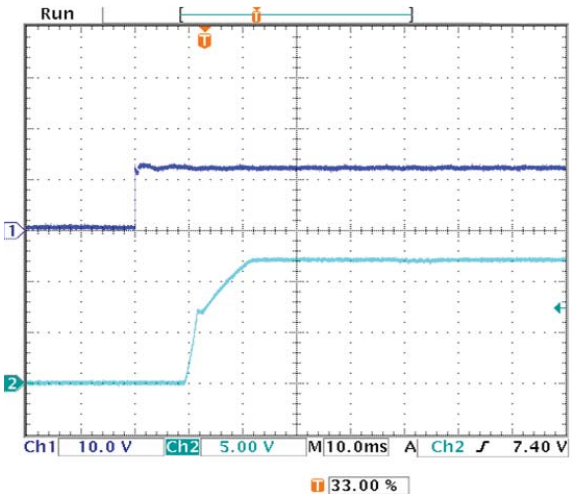


Maximum Current Temperature Derating @sea level
(V_{IN} = 36V, air flow from Pin 1 to Pin 3, with baseplate)

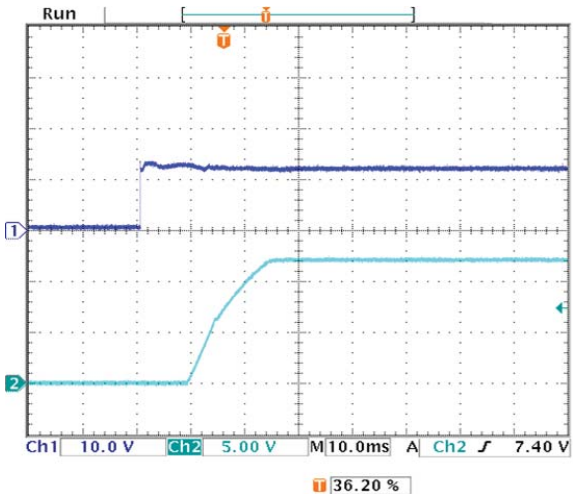


PERFORMANCE DATA, UWE-12/10-Q12

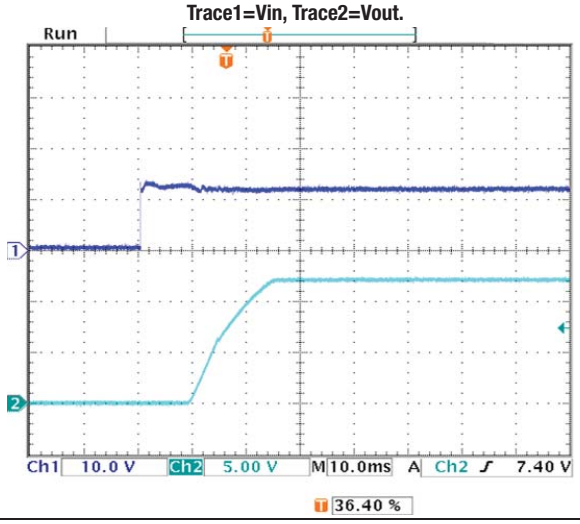
Startup Delay (Vin=12V, Iout=0A, Cout=0, Ta=+25°C) Trace1=Vin, Trace2=Vout.



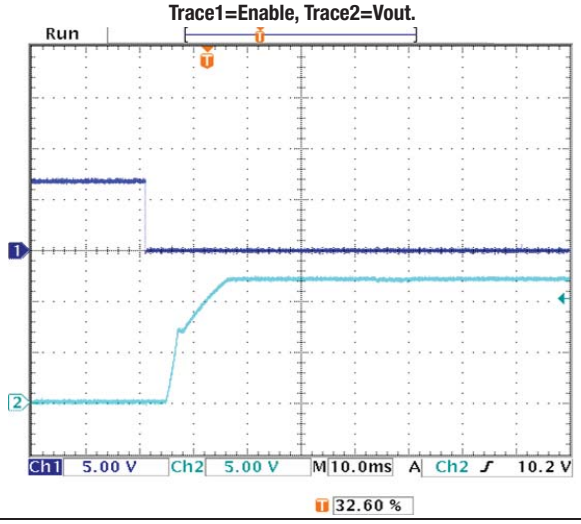
Startup Delay (Vin=12V, Iout=10A, Cout=0, Ta=+25°C) Trace1=Vin, Trace2=Vout.



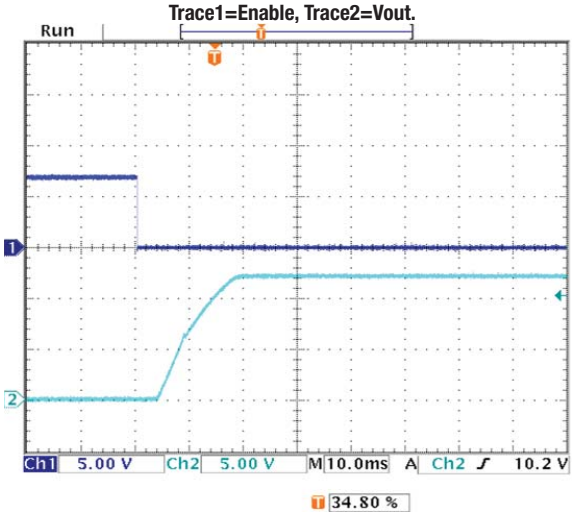
Startup Delay (Vin=12V, Iout=10A, Cout=5000µF, Ta=+25°C) Trace1=Vin, Trace2=Vout.



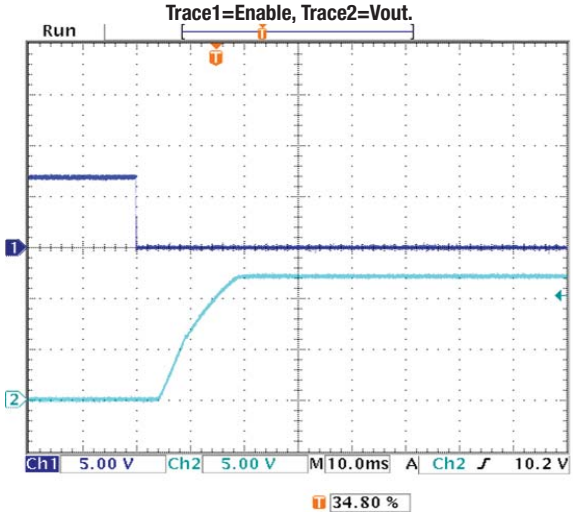
On/Off Enable Delay (Vin=12V, Iout=0A, Cout=0, Ta=+25°C) Trace1=Enable, Trace2=Vout.



On/Off Enable Delay (Vin=12V, Iout=10A, Cout=0, Ta=+25°C) Trace1=Enable, Trace2=Vout.

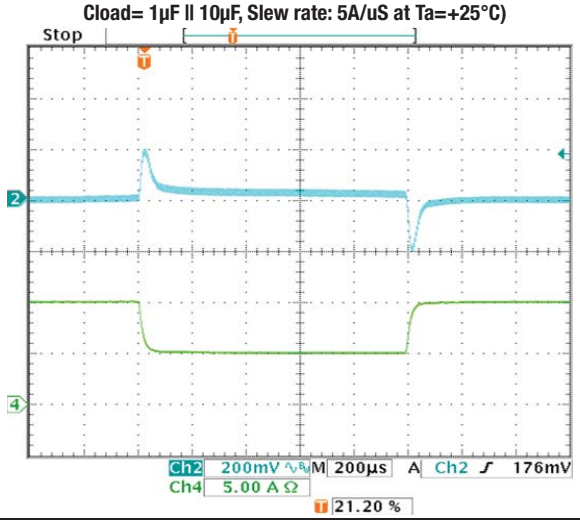


On/Off Enable Delay (Vin=12V, Iout=10A, Cout=5000µF, Ta=+25°C) Trace1=Enable, Trace2=Vout.

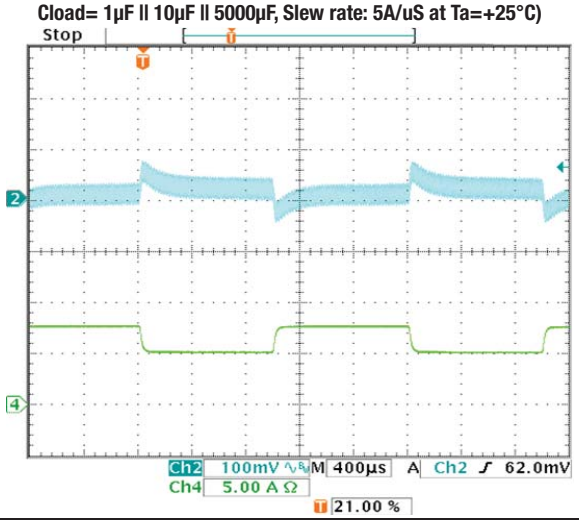


PERFORMANCE DATA, UWE-12/10-Q12

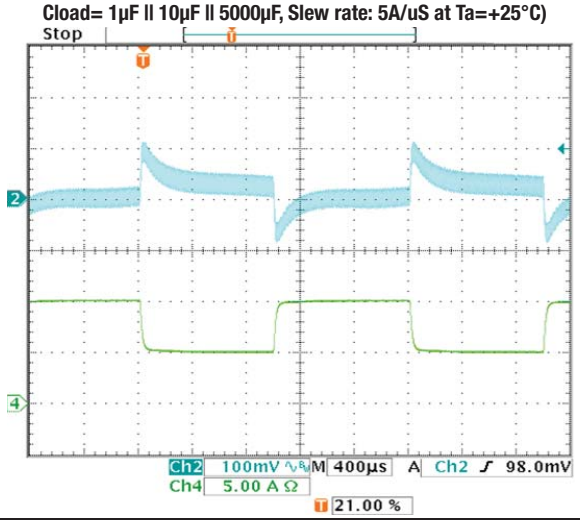
Stepload Transient Response (Vin=12V, Iout=50-100-50% of Iout, Cload= 1µF ll 10µF, Slew rate: 5A/uS at Ta=+25°C)



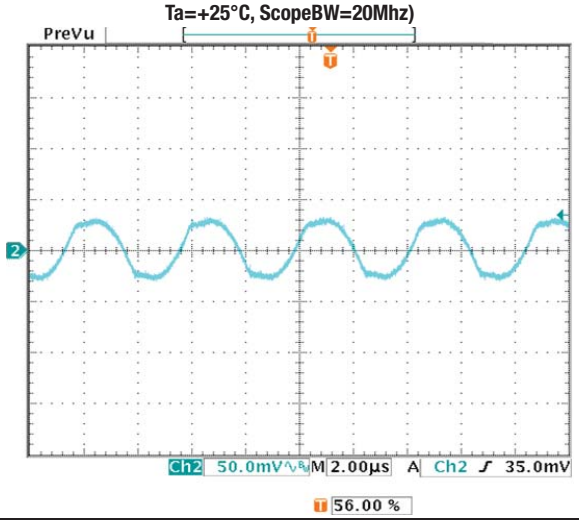
Stepload Transient Response (Vin=12V, Iout=50-100-50% of Iout, Cload= 1µF ll 10µF ll 5000µF, Slew rate: 5A/uS at Ta=+25°C)



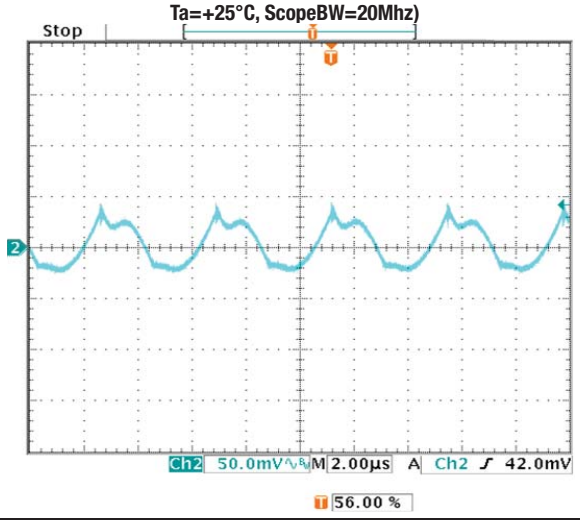
Stepload Transient Response (Vin=12V, Iout=50-75-50% of Iout, Cload= 1µF ll 10µF ll 5000µF, Slew rate: 5A/uS at Ta=+25°C)



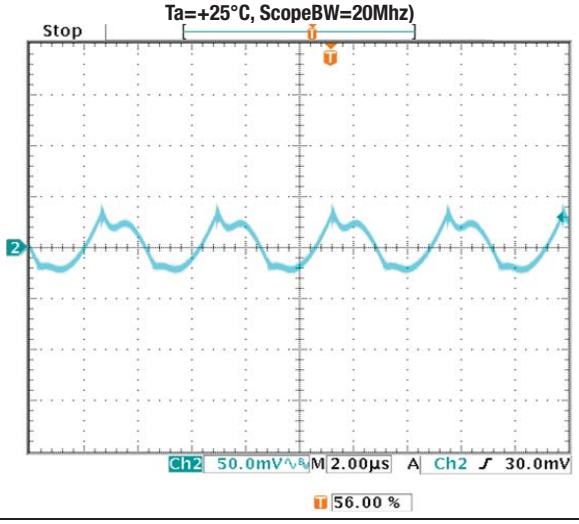
Output Ripple and Noise (Vin=12V, Vout=nom, Iout=0A, Cout=1F ll 10µF, Ta=+25°C, ScopeBW=20Mhz)



Output Ripple and Noise (Vin=12V, Vout=nom, Iout=10A, Cout=1F ll 10µF, Ta=+25°C, ScopeBW=20Mhz)



Output Ripple and Noise (Vin=12V, Vout=nom, Iout=10A, Cout=1F ll 10µF ll 5000µF, Ta=+25°C, ScopeBW=20Mhz)



PERFORMANCE DATA, UWE-12/10-Q12

Thermal image with hot spot at 8.66A current with 25°C ambient temperature. Natural convection is used with no forced airflow. Identifiable and recommended maximum value to be verified in application. Vin=12V, Q6 is the hot spot.