

UWS Series

FEATURES

- High efficiency synchronous flyback topology
- 18-75 Volts DC wide input range with 3.3, 5 and 12 Volts for Output voltage
- Up to 54 Watts total output power with overtemperature shutdown
- Tiny 1.30" x 0.90" x 0.36" open frame package
- Industry standard DOSA "brick" format and pinout
- Extensive self-protection shut down features
- Small footprint DC-DC converter, ideal for high current applications
- 2250 Volt Basic input/output isolation (48V models)
- Operating temperature range -40 to +85°C with derating
- Stable no-load operation with no required external components
- Certified to UL 60950-1, 2nd Edition, EN60950-1 safety approvals



PRODUCT OVERVIEW

The world of "brick" DC-DC converters has seen a steady size reduction. The UWS series makes another dramatic size shrink down to a "sixteenthbrick" width (0.90 inches) while still retaining a high power output and full 2250 Volt DC isolation. The PC-board mount converter family accepts 18 to 75 Volts DC inputs and delivers fixed outputs regulated to within $\pm 0.125\%$. The UWS converters are ideal for datacom and telecom applications, cell phone towers, data centers, server farms and network repeaters.

UWS outputs may be trimmed while delivering fast settling to current step loads and no adverse effects from higher capacitive loads. Excellent ripple and noise specifications assure compatibility to circuits using CPU's, ASIC's, programmable logic and FPGA's. No minimum load is required. For systems requiring controlled startup/shutdown, an external remote On/Off control may use a switch, transistor or digital logic.

Sixteenth-brick DOSA-Compatible,

Many self-protection features on the UWS series avoid both converter and external circuit hazards. These include input undervoltage lockout and overtemperature shutdown. The output of these DC-DC converters have current limit using the "hiccup" autorestart technique and the outputs may be short-circuited indefinitely. Additional features include output overvoltage and reverse conduction elimination.

The synchronous flyback topology yields high efficiency for minimal heat buildup and "no fan" operation.



Typical topology is shown. Murata Power Solutions recommends an external fuse.



UWS Series

Sixteenth-brick DOSA-Compatible, Wide Input Isolated DC-DC Converters

PERFORMANCE SF	PECIFIC	CATIONS S	JMMAR	AND ORDI	ERING GUID	E ①								
	Output				Input				Efficiency		C76			
Root Model ①	Vout	Іоит	Power	R/N (m\	/ pk-pk)	Regulation	n (max.) ③	VIN Nom.	Range	lin, no load	lın, full	EIIICI	ency	Package
	(V)	(A, max.)	(W)	Тур.	Max.	Line	Load	(∀)	(∀)	(mA)	load (A)	Min.	Тур.	Case (inches)
UWS-3.3/15-Q48	3.3	15 ④	49.5	90	125	±0.15%	±0.3%	48	18-75	25	1.16	87.5%	89%	1.30 x 0.90 x 0.36
UWS-5/10-Q48	5	10 5	50	90	130	±0.125%	±0.125%	48	18-75	30	1.14	88%	91%	1.30 x 0.90 x 0.36
UWS-12/4.5-Q48	12	4.5 6	54	115	150	±0.125%	±0.125%	48	18-75	25	1.24	89%	91%	1.30 x 0.90 x 0.36

1 1 Please refer to the Part Number Structure when ordering.

@ All specifications are at nominal line voltage and full load, +25°C unless otherwise noted. See detailed specifications. Output capacitors are 1 μF ceramic multilayer in parallel with 10 $\mu F.$

I/O caps are necessary for our test equipment and may not be needed for your application.

③ Regulation specifications describe output voltage deviations from a nominal/midpoint value to either extreme (50% load step).

④ lout = 13A max. if Vin < 36V.

⑤ lout=8A max. if Vin <36V.



- ① Special quantity order is required; samples available with standard pin length only.
- 2 SMT (M) versions not available in sample quantities.
- ③ Some model number combinations may not be available. See website or contact your local Murata sales representative.

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Sixteenth-brick DOSA-Compatible, Wide Input Isolated DC-DC Converters

FUNCTIONAL SPECIFICATIONS, UWS-3.3/15-Q48

Input Voltage, Continuous Input Voltage, Transient Isolation Voltage Input Reverse Polarity On/Off Remote Control Output Power Output Current Storage Temperature Range Absolute maximums are stress ratings. Exposure	Full temperature range Operating or non-operating, 100 mS max. duration Input to output tested None, install external fuse Power on or off, referred to -Vin	0		80	Vdc
solation Voltage nput Reverse Polarity In/Off Remote Control Jutput Power Jutput Current Storage Temperature Range	duration Input to output tested None, install external fuse Power on or off, referred to -Vin				140
nput Reverse Polarity In/Off Remote Control Iutput Power Iutput Current itorage Temperature Range	None, install external fuse Power on or off, referred to -Vin			100	Vdc
n/Off Remote Control Jutput Power Jutput Current itorage Temperature Range	Power on or off, referred to -Vin			2250	Vdc
utput Power utput Current torage Temperature Range		•	None		Vdc
utput Current Storage Temperature Range		0		15	Vdc
Storage Temperature Range		0		50	W
	Current-limited, no damage, short-circuit protected	0		15	A
bsolute maximums are stress ratings. Exposure	Vin = Zero (no power)	-55		125	С°
isted in the Performance/Functional Specification		ly adversely affect lon	ıg-term reliability. Proper ope	ation under conditions	s other than tho
perating voltage range		18	48	75	Vdc
Recommended External Fuse	Fast blow	10	6		A
Start-up threshold	Rising input voltage	16.5	17	17.9	Vdc
Indervoltage lockout	Falling input voltage	15	16.25	17.50	Vdc
Dvervoltage shutdown	Rising input voltage		None		Vdc
leverse Polarity Protection	None, install external fuse		None		Vdc
nternal Filter Type			LC		100
nput current	1				
Full Load Conditions	Vin = nominal		1.16	1.19	A
Low Line	Vin = minimum, 13A load		2.63	2.72	A
Inrush Transient			0.4		A2-Sec.
Output in Short Circuit			100	200	mA
No Load Input current	lout = minimum, unit=0N		25	60	mA
Shut-Down mode Input Current (Off, UV, OT)			5	10	mA
Reflected (back) ripple current 2	Measured at input with specified filter		15	30	mA, pk-pl
Pre-biased startup	External output voltage < Vset		Monotonic		πл, рк-рг
GENERAL and SAFETY			WONOLOHIC		
denenae allu Sal el l	Vin=48V, full load	87.5	89		%
Efficiency	Vin=24V, full load	88.5	90.5		%
solation	VIII-2+V, 10111000	00.0	50.0		70
Isolation Voltage, Input to Output		2250			Vdc
Insulation Safety Rating		2200	basic		Vuo
Isolation Resistance			100		MΩ
Isolation Capacitance			1300		pF
	Certified to UL-60950-1, IEC/EN60950-1,		1300		pi
Safety	2nd Edition		Yes		
Calculated MTBF	Per Telcordia SR332, issue 1, class 3, ground fixed, Tambient=+25°C		3.0		Hours x 10
DYNAMIC CHARACTERISTICS					
ixed Switching Frequency		250	280	310	KHz
Power Up Startup Time	Power On to Vout regulated			30	mS
Dn/Off Startup Time	Remote ON to Vout regulated			30	mS
nivon startup mine	50-75-50% load step, settling time to within		100	200	μSec
Dynamic Load Response	±1% of Vout		100	±240	mV
Dynamic Load Response			±180		
Dynamic Load Response Dynamic Load Peak Deviation EATURES and OPTIONS	±1% of Vout		±180		
Dynamic Load Response Dynamic Load Peak Deviation EATURES and OPTIONS	±1% of Vout		±180		
Dynamic Load Response Dynamic Load Peak Deviation EATURES and OPTIONS Remote On/Off Control ©	±1% of Vout		±180		
Dynamic Load Response Dynamic Load Peak Deviation EATURES and OPTIONS Remote On/Off Control © 'N" suffix	±1% of Vout	-0.1	±180	0.8	Vdc
Dynamic Load Response Dynamic Load Peak Deviation FEATURES and OPTIONS Remote On/Off Control ©	±1% of Vout Same as above,	-0.1 2.5	±180	0.8	Vdc Vdc
Dynamic Load Response Dynamic Load Peak Deviation EATURES and OPTIONS Remote On/Off Control © 'N" suffix Negative Logic, ON state	±1% of Vout Same as above, ON=Pin grounded or external voltage		±180	15	
Dynamic Load Response Dynamic Load Peak Deviation EATURES and OPTIONS Remote On/Off Control © 'N" suffix Negative Logic, ON state Negative Logic, OFF state Control Current	±1% of Vout Same as above, ON=Pin grounded or external voltage OFF=Pin open or external voltage				Vdc
Dynamic Load Response Dynamic Load Peak Deviation FEATURES and OPTIONS Remote On/Off Control © 'N" suffix Negative Logic, ON state Negative Logic, OFF state Control Current 'P" suffix	±1% of Vout Same as above, ON=Pin grounded or external voltage OFF=Pin open or external voltage Open collector/drain, sourcing	2.5		15 2	Vdc mA
Dynamic Load Response Dynamic Load Peak Deviation FEATURES and OPTIONS Remote On/Off Control © 'N" suffix Negative Logic, ON state Negative Logic, OFF state	±1% of Vout Same as above, ON=Pin grounded or external voltage OFF=Pin open or external voltage			15	Vdc

UWS Series

Sixteenth-brick DOSA-Compatible, Wide Input Isolated DC-DC Converters

FUNCTIONAL SPECIFICATIONS, UWS-3.3/15-Q48 (CONT.)

OUTPUT	Conditions ①	Minimum	Typical/Nominal	Maximum	Units
Total Output Power	See Derating	0.0	49.5	50	W
Voltage	Ŭ T		-1		
Nominal Output Voltage	No trim	3.267	3.3	3.333	Vdc
Setting Accuracy	At 50% load		±1		% of Vnom.
Output Voltage Range	User-adjustable	-10		10	% of Vnom.
Overvoltage Protection	Via magnetic feedback	4	4.3	4.9	Vdc
Current					
Output Current Range	Vin=18V-36V	0.0		13.0	Α
Output Current Range	Vin=36V-75V	0.0		15.0	Α
Minimum Load			No minimum load		
Current Limit Inception	98% of Vnom., after warmup	18.4	21.9	25.4	A
Short Circuit					
Short Circuit Current	Hiccup technique, autorecovery within ±1.25% of Vout		0.6		А
Short Circuit Duration (remove short for recovery)	Output shorted to ground, no damage		Continuous		
Short circuit protection method	Current limiting				
Regulation ⑦					
Line Regulation	Vin=min. to max., Vout=nom., full load			±0.15	%
Load Regulation	lout=min. to max., Vin=48V			±0.3	%
Ripple and Noise	With a 1uF 10uF output caps		90	125	mV pk-pk
••	With a 1uF 100uF output caps		60		mV pk-pk
Temperature Coefficient	At all outputs		±0.02		% of Vnom./°C
Remote Sense Compensation ⁽¹⁾	Sense connected at load			10	% of Vout
Maximum Capacitive Load	Constant resistance mode , low ESR	0	10,000		μF
MECHANICAL					
Outline Dimensions	Cxx case		1.30x0.90x0.36		Inches
(Please refer to outline drawing)	LxWxH		33.0x22.9x9.1		mm
Weight			0.48		Ounces
			13.6		Grams
Through Hole Pin Diameter			0.040 & 0.060		Inches
			1.02 & 1.52		mm
Through Hole Pin Material			Copper alloy		
TH Pin Plating Metal and Thickness	Nickel subplate	50			µ-inches
	Gold overplate	5			µ-inches
EMI/RFI Shielding			None		
ENVIRONMENTAL			NULLE		
Operating Ambient Temperature Range	See derating, full power, natural convection	-40		85	°C
Operating Case Temperature Range	No derating, full power, natural convection	-40		105	<u> </u>
Storage Temperature	Vin = Zero (no power)	-40		125	<u> </u>
		115	125	125	<u> </u>
Thermal Protection/Shutdown					
	Measured in center	115	125	100	
Thermal Protection/Shutdown Electromagnetic Interference Conducted, EN55022/CISPR22	External filter is required	115	B	100	Class

UWS Series



UWS Series



UWS Series

Sixteenth-brick DOSA-Compatible, Wide Input Isolated DC-DC Converters

FUNCTIONAL SPECIFICATIONS, UWS-5/10-Q48

Operating rono-operating tested: 100 nm max duration 0 100 Vdc Isolation Voltage input Reverse Polarity None, install external tuse None 2250 Vdc Group Reverse Polarity None, install external tuse None 100 Status GroUP Reverse Control Querent-Imited, no carage, stort-incut protected 0 50.63.3 W Storage temperature Range Vm = 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 these isted in the PerformanceFunctional Specifications Table is not implied or recommended. Top A NPUT Fast blow 18 49 75 Vdc Operating voltage range Fast blow 18 40 75 Vdc Recommended External Fuse Fast blow 18 40 75 Vdc Recommended External Fuse Fast blow 16.1 17.5 17.9 Vdc Reverse Polarity Protection None, install external fuse None Vdc Vdc	ABSOLUTE MAXIMUM RATINGS	Conditions ①	Minimum	Typical/Nominal	Maximum	Units
Input to origin, instant 100 ms max, duration u 100 000 000 Input Reverse Polarity None, instal automal face None Note Note Output Corrent Power on, referred to Nin 0 100 A Storage Temperature Range Current-limited, no damage, ibnit-ficult protected 0 100 A Storage Temperature Range Current-limited, no damage, ibnit-ficult protected 0 100 A Storage Temperature Range Current-limited, no damage, ibnit-ficult protected 0 100 A Storage Temperature Range Current-limited, no damage, ibnit-ficult protected 100 A A Storage Temperature Range Current-limited, no damage, ibnit-ficult protected 100 A A Work Reverse Polarina Fisse Faste protected NA Vide Vide Protectabe, history Protection None, instal atternal fisse NA Vide Vide Protectabe, history Protection None, instal atternal fisse No Vide Vide Protectabe, history Protection <t< th=""><th>Input Voltage, Continuous</th><th>Full temperature range</th><th>0</th><th></th><th>80</th><th>Vdc</th></t<>	Input Voltage, Continuous	Full temperature range	0		80	Vdc
Isolation Voltage Imput Powers Point Power on, referred to -Vin O Power on, referred to -Vin O None Vic Vic OutQU Power Ornert Hennets Control Operating and the power on, referred to -Vin O 10.0 A Storage Temperature Range Um - Zaro (on power) -55 10.0 A Storage Temperature Range Um - Zaro (on power) -55 17.5 17.0 A Storage Temperature Range Descontermented 18 48 75 Vic Absolde mainturus are stress ratings. Exposue of devices to greater than ary of these contitions may adversely affect burg-term reliability. Poper operation under contitions of the then three liability. Poper operation under contitions of the than three liability. Poper operation under contitions of the than three liability. Poper operation under contitions of the three maintures of the poperating data and the poperation under contitions of the then three liability. Poper operation under contitions of the poperation and the poperation of the poperation under contitions of the poperation poperation under contitions of the poperation poperation and the poperation poperation poperation and the poperation poperation poperation poperation and the poperation poperatin poperatin storage term poperation poperatin storage term poper	Input Voltage, Transient		0		100	Vdc
Dn/Off Renorae Cantrol Output Power Operation and States of States and States of States and States of States and State	Isolation Voltage				2250	Vdc
Dn/Off Renorae Cantrol Output Power Operation and States of States and States of States and States of States and State				None		
Output Current Control Immed, including and part of the continuous of the contecont of the continuous of the contecont of the continuo	· · · · · · · · · · · · · · · · · · ·		0		15	Vdc
Storage Emperature Range Vm zero (no power) 55 12.5 "C Absolut maximum seriests range seriests and are seriest ran ary of these contitions may adversely affect long-turm reliability. Proper operation under conditions there than those its its in the Performance/Functional Specifications Table is not implied or recommended. WI Operating valtage range 18 43 75 Vdo Recommended External Fuse Fast How 15 17.5 17.9 Vdo Operating shufdown, turn off Fast How 16 18.7 17.5 Vdo Operating shufdown, turn off Fast How 16 18.7 17.5 Vdo Operating shufdown, turn off Fast How 16 18.7 Vdo Vdo Reverse Polarity Protection None, install external fuse None Vdo Reverse Polarity Protection Vdo Fast Goodfitions Vin = monimal 1.114 1.2 A Low Lone Vin = minimum 2.44 2.51 A Low Lone Vin = minimum 100 2.00 mA Shuf-Dow Mode fungu Current	Output Power		0		50.63	W
Absolute maximum are stress ratings. Exposure of devices to greater than any of these constituts may adversely affect long-term reliability. Proper operation under conditions other than those issel in the Protocol alsy schedules and the protocol also and preperior also also are protocol also as a protocol	Output Current	Current-limited, no damage, short-circuit protected	0		10	A
Used in the PerformanceFunctional Specifications Table is not implied or recommended. Note Secture <	Storage Temperature Range	Vin = Zero (no power)	-55		125	0°
INPUT Image: Solution of the set blow 18 48 75 Vdc Recommended External Fuse Fast blow 16.5 17.5 17.9 Vdc Brownonge shutdown, turn off Falling input voltage 15 16.75 17.7.5 Vdc Overvoltage shutdown, turn off Falling input voltage 15 16.75 17.7.5 Vdc Overvoltage shutdown, turn off Falling input voltage 15 16.7.5 17.7.5 Vdc Indervoltage shutdown, turn off Problem Loc Vdc Vdc Vdc Internal Filter Type Loc Loc Vdc Vdc A Sc A Sc A A Sc A A			ay adversely affect lon	g-term reliability. Proper ope	eration under condition	s other than those
Operating vitage range number of the second se						
Recommended External Puse Bartury thresholds, turn on Orientage shutdown, turn offFast blow Niking input voltage 15.17.5.17.9.Vice Vice Vice Dirent PuseDervoltage shutdown, turn offFalling input voltage not not shutdown15.17.5.17.5.Vice ViceReverse Polarity ProtectionNone, install external fuseNoneNoneViceViceImput CurrentLow LongLowLowLowViceInguest ConditionsVin = nominal1.1.4.1.2.ALow LongVin = minimum, unit=0N0.4.2.44.2.5.1.ALow LongUnit100200mAS1.0.mANo Load Input CurrentIout = minimum, unit=0N3060mAS1.0.mAReflected (back) fipple current 20No filtering1.50200mAp-pPShut-Down Mode Input Current 20No filtering1.50200mAp-pPro-blased startupExternal output voltage < Vset	Operating voltage range		18	48	75	Vdc
Undervoltage shutdown, um offFalling input voltage1516.7517.5VdcReverse Polarity ProtectionNone, install external fuseNoneVdcVdcInternal Filter TypeLCVdcVdcInternal Filter TypeLCVdcVdcInternal Filter TypeLCXdcVdcInternal Filter TypeLCAXdcInternal Filter TypeLCAXdcFall Ead ConditionsVin = nominal1.141.2ALow LineVin = nimimum2.442.51AInrush TransientIot = minimum, unl=0N3060mANo Load Input CurrentIot = minimum, unl=0N3060mAShut-Down Modo Input CurrentMo filtering150200mAp-pPre-biased start typeExternal output voltage Monotonic%CiftENAL and SAFEYVin-48V, full load8891%CiftENAL and SAFEYVin-48V, full load88.591%Isolation ResistanceIot100MCMCIsolation ResistanceIot100MCMCIsolation ResistanceIot100MCMCIsolation ResistanceIot100MCMCIsolation ResistancePer Telcordis 8832, issue 1, dass 3, ground fixed, mabient=+25°C30mSDynamic Load Post ResistanceIot And MC30mSMCIsolation ResistanceRenna Oh		Fast blow				
Undervoltage shutdown, um offFalling input voltage1516.7517.5VoicReverse Polarity ProtectionNone, install external fuseNoneVoicVoicInternal Filter TypeLCVoicInternal Filter TypeLCVoicInternal Filter TypeLCVoicInternal Filter TypeLCALow LineVin = nominal1.141.2ALow LineVin = nominal2.442.51ALow LineVin = nominal0.4A2-Sec.Joutput in Stort CircuitIout = minimum, unl=0N3060mANo Load Input CurrentIout = minimum, unl=0N510mAReflected (back) ripple current ©Mo filtering150200mAp-pPre-biased start typeExternal output voltage < Vset			16.5	17.5	17.9	
Over-otigge shutdown VA Vdc Vdc Internal Filter Type None, install external fuse None Vdc Internal Filter Type I.G I.G Vdc Full Load Conditions Vin = nominal 1.14 1.2 A Low Line Vin = minimum 2.44 2.51 A Inrush Transfert 0.4 A2-Sac. A Output in Short Circuit I.out = minimum, unit=0N 3.0 6.0 mA No Load Input Current I.out = minimum, unit=0N 3.0 6.0 mA Shuri-Down Mode Input Current No filtering 15.0 2.00 mA Reflected (back) ripple current © Measured at input with specified filter 15 3.0 mAp-p Pre-biased startup External output voltage < Vset			15	16.75	17.5	Vdc
Internal Filter Type LC LC Full Load Conditions Vin = nominal 1.14 1.2 A Low Line Vin = minimum 2.44 2.51 A Inrush Transient 0.4 .42-5ac. A Output in Short Circuit 100 200 mA No Load Input Current lout = minimum, unt=ON 30 60 mA Shut-Down Mode Input Current lout = minimum, unt=ON 30 mAp-p mAp-p Reflected Backy ripple current @ No filtering 150 200 mAp-p Reflected Backy ripple current @ Measured at input with specified filter 15 30 mAp-p Reflected Backy ripple current @ Nin=24V, full load 89.5 91 % Stolation Stolation Sterry Rating 2250 Mac MO Isolation Chaga-Input to Uuput Vin=24V, full cond 89.5 91 % Isolation Sterry Rating UL-00950-1, CSA-C22.2 No 60950-1, 1000 MO pF Isolation Stery Rating 100 MO	Overvoltage shutdown			NA		Vdc
Internal Filter Type LC LC Full Load Conditions Vin = nominal 1.14 1.2 A Low Line Vin = minimum 2.44 2.51 A Inrush Transient 0.4 .42-58c. A Output in Short Circuit 100 2.00 mA No Load Input Current lout = minimum, unit=ON 30 60 mA Shut-Down Mode Input Current lout = minimum, unit=ON 30 00 mAp-p Reflected Backy ripple current @ No filtering 150 200 mAp-p Reflected Backy ripple current @ Measured at input with specified filter 15 30 mAp-p Reflected Backy ripple current @ Measured at input with specified filter 15 30 mAp-p Reflected Backy ripple current @ Measured at 89.5 91 % % Isolation Sturt-Dougan 2250 Mas % % Isolation Capacitance 100 MC pF % % Isolation Starety Rating 2250 <th></th> <td>None, install external fuse</td> <td></td> <td>None</td> <td></td> <td>Vdc</td>		None, install external fuse		None		Vdc
Full Lad Conditions Vin = nominal 11.4 1.2 A Low Line Vin = minimum 2.44 2.51 A Inrush Transient 0.4 0.4 A2-Sec. Output in Short Circuit 100 200 mA No Load Input Current lout = minimum, unit=0N 30 60 mA Shut-Down Mode Input Current No filtering 150 200 mAp-p Reflected Back/ ripple current ② Measured at input with specified filter 15 30 mAp-p Reflected Back/ ripple current ③ Measured at input with specified filter 15 30 mAp-p Reflected Back/ ripple current ③ Measured at input with specified filter 15 30 mAp-p Reflected Back/ ripple current ③ Measured at input with specified filter 15 30 mAp-p Reflected Back/ ripple current ③ Nin=24V, full load 89.5 91 % Isolation Vin=24V, full load 89.5 91 % Isolation Voltage, input to Output 2250 Masin Vin Isolation Galexitance 100 MO pF Startup Time Per Telocrida SR332, issue 1, class 3, ground filter 3.0 Hours x 10 ⁶ Ovinamic Load Response	Internal Filter Type					
Low Line Vin = minimum 2.44 2.51 A Innush Transient 0.4 A2.Sec. 0.44 A2.Sec. Output in Short Circuit 100 200 mA No Load Input Current lout = minimum, unit=0N 30 60 mA Shur-Down Mode Input Current Instance 5 10 mA Reflected (back) ripple current @ Messured at input with specified filter 15 30 mAp-p Breflected (back) ripple current @ Messured at input with specified filter 15 30 mAp-p Breflected (back) ripple current @ Vin=48V, full load 88 91 % Stalation Voltage, Input to Output External output voltage vset Monotonic % Isolation Safety Rating Locottopic 2250 Vdc MO Isolation Capacitance 100 MO MO MO Isolation Capacitance UL-60950-1, CSA-C22.2 No.60950-1, ICSA-C22.2 No.60950-1, ICS	Input current					
Inrush Transient On 4 A2-Sec. Output in Short Circuit 100 200 mA No Load Input Current Iout = minimum, unit=ON 30 60 mA Shut-Down Mode Input Current No filtering 150 200 mAp-p Reflected Bocky ripple current @ Measured at input with specified filter 15 30 mAp-p Reflected Bocky ripple current @ Measured at input with specified filter 15 30 mAp-p Reflected Bocky ripple current @ Measured at input with specified filter 15 30 mAp-p Reflected Bocky ripple current @ Measured at input with specified filter 15 30 mAp-p Reflected Bocky ripple current @ Measured at input with specified filter 15 30 mAp-p Bolation Statery Atting External output voltage < Vset	Full Load Conditions	Vin = nominal		1.14	1.2	Α
Output in Short Circuit Iout = minimum, unit=0N 100 200 mA No Load Input Current Iout = minimum, unit=0N 30 60 mA Reflected (back) ripple current @ No filtering 150 200 mAp-p Reflected (back) ripple current @ Measured at input with specified filter 15 30 mAp-p Pre-biased Startup External output witage < Vset	Low Line	Vin = minimum		2.44	2.51	Α
No Load Input Current Iout = minimum, unit=0N 30 60 mA Shut-Down Mode Input Current 0 5 10 mA Reflected (back) ripple current ② Me Saured a tinput with specified filter 150 200 mAp-p Pre-biased Startup External output voltage < Vset	Inrush Transient			0.4		A2-Sec.
Shut-Down Mode Input Current 5 10 mA Reflected (back) ripple current ② Measured at input with specified filter 150 200 mAp-p Reflected (back) ripple current ③ Measured at input with specified filter 15 30 mAp-p Reflected (back) ripple current ③ Measured at input with specified filter 15 30 mAp-p Reflected (back) ripple current ③ Measured at input with specified filter 15 30 mAp-p Reflected (back) ripple current ④ Measured at input with specified filter 150 30 mAp-p Reflected (back) ripple current ④ Vin=24V, full load 88 91 % Stolation Stolation Stolation % % Isolation Keisstance 100 MO MO Isolation Capacitance 1000 MO MO Stafety (meets the following requirements) LEC/EN60950-1, 2nd Edition Yes Stafety (meets the following requirements) LEC/EN60950-1, 2nd Edition Yes Stafety (meets the following requirements) Per Telcordia SR32,	Output in Short Circuit			100	200	mA
Reflected (back) ripple current ② No filtering 150 200 mAp-p Reflected (back) ripple current ③ Measured at input with specified filter 15 30 mAp-p Pre-biased startup External output voltage < Vset	No Load Input Current	lout = minimum, unit=ON		30	60	mA
Reflected (back) ripple current \textcircled{O} Measured at input with specified filter 15 30 mAp-p Pre-biased startup External output voltage < Vset	Shut-Down Mode Input Current			5	10	mA
Reflected (back) ripple current ($)$ Measured at input with specified filter1530mAp-pPre-bised startupExternal output voltage < Vset	Reflected (back) ripple current 2	No filtering		150	200	mAp-p
Pre-biased startup External output voltage < Vset Monotonic GRNERAL and SAFETY Vin=48V, full load 88 91 96 Efficiency Vin=48V, full load 89.5 91 96 Isolation Isolation Voltage, Input to Output 0 Vdc 96 Isolation Nation Safety Rating 2250 basic Vdc Isolation Resistance 1000 MΩ Isolation Calculated MIDF Pc Isolation Resistance UL-60950-1, CSA-C22.2 No 60950-1, IEC/EN00950-1, 2nd Edition Yes Pc Calculated MTBF Per Telcordia SR32, issue 1, class 3, ground fixed, Tambient=+25°C 3.0 Hours x 10 ⁶ OYNAMUC CHARACTERISTICS Per Telcordia SR32, issue 1, class 3, ground fixed, Tambient=+25°C 30 mS Dynamic Load Response 50-75-50% load step, settling time to within ±1% of Vout regulated 30 mS Dynamic Load Response 50-75-50% load step, settling time to within ±1% of Vout 100 200 µSec Dynamic Load Peak Deviation Same as above, ±180 ±240 mV FEATURES Control Current Of PF Pin open or external voltage O/ 1 0.8 V Viffix Or Sate		Measured at input with specified filter		15	30	mAp-p
GENERAL and SAFETY Vin=48V, full load 88 91 %6 Efficiency Vin=24V, full load 89.5 91 %6 Isolation Vin=24V, full load 89.5 91 %6 Isolation Safety Rating 2250 Vdc Vdc Isolation Resistance 100 MΩ Safety (meets the following requirements) VL-60950-1, CSA-C22.2 No.60950-1, ICCA-C02.2 No.60950-1	. , , , , , , , , , , , , , , , , , , ,					
Hitelacy Vin=48V, full load 88 91 % Isolation Vin=24V, full load 89.5 91 % Isolation Voltage, Input to Output 2250 Vdc % Isolation Safety Rating 2250 MG MG Isolation Capacitance 100 MG MG Isolation Resistance 1000 MG MG Safety (meets the following requirements) IEC/ENR0950-1, 2nd Edition Yes Fer Calculated MTBF Per Telcordia SR332, issue 1, class 3, ground fixed, Tambient=+25°C 3.0 Hours x 10 th DYNAMIC CHARACTERISTICS Free Remote ON to Vout regulated 3.0 mS Startup Time Remote ON to Vout regulated 30 mS Dynamic Load Response 50-75-50% load step, settling time to within ±1% of Vout 100 200 µSec Premote On/Off Control ® ************************************						
VIII=24V, UII 1020 89.5 91 70 Isolation 100 100 Vdc Insulation Safety Rating 2250 100 MΩ Isolation Resistance 100 MΩ 100 MΩ Isolation Resistance 1000 PF 1000 PF Safety (meets the following requirements) UL-60950-1, CSA-C22.2 No.60950-1, 204 Edition Yes 1000 PF Calculated MTBF UL-60950-1, CSA-C22.2 No.60950-1, 204 Edition Yes 100 Hours x 10° DYNAMIC CHARACTERISTICS Per Telcordia SR332, issue 1, class 3, ground fixed, Tambient=+25°C 3.0 Hours x 10° Startup Time Power On to Vout regulated 3.0 mS Startup Time Startup Time Remote ON to Vout regulated 30 mS Startup Time 200 µSec Dynamic Load Response 50-75-50% load step, setting time to within ±1% of Vout 100 200 µSec Dynamic Load Peak Deviation Same as above, ±180 ±240 mV FEATURES and OPTIONS Same as above, ±180	GENERAL and SAFETY			Wohotomo		
Isolation Voltage, Input to Output Vdc Insulation Safety Rating 0 basic 0 Isolation Resistance 100 MΩ Isolation Capacitance 1000 pF Safety (meets the following requirements) 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 3.0 Hours x 10 ⁶ DYNAMIC CHARACTERISTICS ************************************	GENERAL and SAFETY		88			%
Insulation Safety Rating basic M Isolation Resistance 100 MΩ Isolation Capacitance 100 pF Safety (meets the following requirements) UL-60950-1, CSA-C22.2 No.60950-1, IEC/EN60950-1, 2nd Edition Yes PF Calculated MTBF Per Telcordia SR332, issue 1, class 3, ground fixed, Tambient=+25°C 3.0 Hours x 10° DYNAMIC CHARACTERISTICS Frixed, Sayithing Frequency 225 275 325 KHz Startup Time Power On to Vout regulated 30 mS mS Dynamic Load Response 50-75-50% load step, settling time to within ±1% of Vout 100 200 µSec Dynamic Load Response 50-75-50% load step, settling time to within ±1% of Vout 100 200 µSec EFATURES and OPTIONS #180 ±240 mV Remote On/Off Control ® T 2.5 15 V Negative Logic, ON state ON = Pin open or external voltage -0.1 0.8 V Regative Logic, ON state ON = Pin open or external voltage 2.5 15 V <t< td=""><th></th><td>Vin=48V, full load</td><td></td><td>91</td><td></td><td></td></t<>		Vin=48V, full load		91		
Isolation Resistance100MΩIsolation CapacitanceUL-60950-1, CSA-C22.2 No.60950-1, IEC/EN60950-1, 2nd EditionYesPFSafety (meets the following requirements)UL-60950-1, 2nd EditionYesMΩCalculated MTBFPer Telcordia SR332, issue 1, class 3, ground fixed, Tambient=+25°C3.0Hours x 10°DYNAMIC CHARACTERISTICSFreeStartup Time3.0MΩFixed Switching Frequency225275325KHzStartup TimePower On to Vout regulated30mSDynamic Load Response50-75-50% load step, settling time to within ±1% of Vout100200µSecDynamic Load Peak DeviationSame as above,±180±240mVFEATURES and OPTIONS""" suffixVegative Logic, ON stateON = Pin grounded or external voltage-0.10.8VNegative Logic, OFF stateOFF = Pin open or external voltage2.515VControl Current0.8 = Pin open or external voltage2.515VPositive Logic, ON stateON = Pin open or external voltage1015VPositive Logic, ON stateON = Pin open or external voltage1015VOpen collector/drain12mA"""""""ON = Pin open or external voltage00.7V	GENERAL and SAFETY Efficiency	Vin=48V, full load		91		
Isolation Capacitance 1000 pF Safety (meets the following requirements) UL-60950-1, CSA-C22.2 No.60950-1, IEC/EN60950-1, 2nd Edition Yes Calculated MTBF Per Telcordia SR322, issue 1, class 3, ground fixed, Tambient=+25°C 3.0 Hours x 10 ⁶ DYNAMIC CHARACTERISTICS 225 275 325 KHz Startup Time Power On to Vout regulated 300 mS startup Time Dynamic Load Response 50-75-50% load step, settling time to within ±1% of Vout 100 200 µSec Dynamic Load Peak Deviation Same as above, ±180 ±240 mV FEATURES and OPTIONS 0.8 V W" suffix 0.8 V Negative Logic, ON state OFF = Pin open or external voltage 2.5 15 V Control Current open collector/drain 1 2 mA "P" suffix 0.7 V	GENERAL and SAFETY Efficiency Isolation	Vin=48V, full load	89.5	91		%
Safety (meets the following requirements) 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 3.0 Hours x 10 ⁸ DYNAMIC CHARACTERISTICS Fixed Switching Frequency 225 275 325 KHz Startup Time Power On to Vout regulated 30 mS Startup Time Remote ON to Vout regulated 30 mS Dynamic Load Response 50-75-50% load step, settling time to within ±1% of Vout 100 200 µSec Dynamic Load Peak Deviation Same as above, ±180 ±240 mV FEATURES and OPTIONS W************************************	GENERAL and SAFETY Efficiency Isolation Isolation Voltage, Input to Output	Vin=48V, full load	89.5	91 91		%
Safety (meets the following requirements)IEC/EN60950-1, 2nd EditionYesCalculated MTBFPer Telcordia SR332, issue 1, class 3, ground fixed, Tambient=+25°C3.0Hours x 10 ⁶ DYNAMIC CHARACTERISTICSFixed Switching Frequency225275325KHzStartup TimePower On to Vout regulated30mSStartup TimeRemote ON to Vout regulated30mSDynamic Load Response50-75-50% load step, settling time to within ±1% of Vout100200µSecDynamic Load ResponseSame as above,±180±240mVFEATURES and OPTIONSRemote ON/Off Control ©"N" suffixNegative Logic, ON stateON = Pin grounded or external voltage-0.10.8VNegative Logic, OFF stateOFF = Pin open or external voltage2.515VPositive Logic, ON stateON = Pin open or external voltage1015VPositive Logic, ON stateON = Pin open or external voltage00.7V	GENERAL and SAFETY Efficiency Isolation Isolation Voltage, Input to Output Insulation Safety Rating	Vin=48V, full load	89.5	91 91 basic		Vdc
Calculated MTBPfixed, Tambient=+25°C3.0Hours X 10°DYNAMIC CHARACTERISTICSFixed Switching Frequency225275325KHzStartup TimePower On to Vout regulated30mSStartup TimeRemote ON to Vout regulated30mSDynamic Load Response50-75-50% load step, settling time to within ±1% of Vout100200µSecDynamic Load Response50-75-50% load step, settling time to within ±1% of Vout100200µSecDynamic Load Peak DeviationSame as above,±180±240mVFEATURES and OPTIONS"N" suffixNegative Logic, ON stateON = Pin grounded or external voltage-0.10.8VNegative Logic, OFF stateOFF = Pin open or external voltage2.515VPositifixPositifixPositifix Logic, OFF state0N = Pin open or external voltage1015VPositive Logic, OFF state0FF = Ground pin or external voltage00.7V	GENERAL and SAFETY Efficiency Isolation Isolation Voltage, Input to Output Insulation Safety Rating Isolation Resistance	Vin=48V, full load	89.5	91 91 basic 100		% Vdc
Fixed Switching Frequency225275325KHzStartup TimePower On to Vout regulated30mSStartup TimeRemote ON to Vout regulated30mSDynamic Load Response50-75-50% load step, settling time to within ±1% of Vout100200µSecDynamic Load Peak DeviationSame as above,±180±240mVFEATURES and OPTIONSRemote On/Off Control ©"N" suffixNegative Logic, ON stateON = Pin grounded or external voltage-0.10.8VNegative Logic, OFF stateOFF = Pin open or external voltage2.515VControl Current0N = Pin open or external voltage12mA"P" suffix0N = Pin open or external voltage1015VPositive Logic, OFF stateON = Pin open or external voltage1015VPositive Logic, OFF stateON = Pin open or external voltage00.7V	GENERAL and SAFETY Efficiency Isolation Isolation Voltage, Input to Output Insulation Safety Rating Isolation Resistance Isolation Capacitance	Vin=48V, full load Vin=24V, full load UL-60950-1, CSA-C22.2 No.60950-1,	89.5	91 91 basic 100 1000		% Vdc
Startup TimePower On to Vout regulated30mSStartup TimeRemote ON to Vout regulated30mSDynamic Load Response50-75-50% load step, settling time to within ±1% of Vout100200μSecDynamic Load Peak DeviationSame as above,±180±240mVFEATURES and OPTIONS"N" suffixNegative Logic, ON stateON = Pin grounded or external voltage-0.10.8VControl ©""""Per suffixNegative Logic, OFF stateON = Pin open or external voltage2.515VControl Current12mA"Per suffixPositive Logic, ON stateON = Pin open or external voltage1015VPositive Logic, OFF stateOFF = Ground pin or external voltage00.7V	GENERAL and SAFETY Efficiency Isolation Isolation Voltage, Input to Output Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety (meets the following requirements)	Vin=48V, full load Vin=24V, full load UL-60950-1, CSA-C22.2 No.60950-1, IEC/EN60950-1, 2nd Edition Per Telcordia SR332, issue 1, class 3, ground	89.5	91 91 basic 100 1000 Yes		% Vdc ΜΩ pF
Startup Time Remote ON to Vout regulated 30 mS Dynamic Load Response 50-75-50% load step, settling time to within ±1% of Vout 100 200 µSec Dynamic Load Peak Deviation Same as above, ±180 ±240 mV FEATURES and OPTIONS #	GENERAL and SAFETY Efficiency Isolation Isolation Voltage, Input to Output Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety (meets the following requirements) Calculated MTBF	Vin=48V, full load Vin=24V, full load UL-60950-1, CSA-C22.2 No.60950-1, IEC/EN60950-1, 2nd Edition Per Telcordia SR332, issue 1, class 3, ground	89.5	91 91 basic 100 1000 Yes		% Vdc MΩ pF
Dynamic Load Response 50-75-50% load step, settling time to within ±1% of Vout 100 200 µSec Dynamic Load Peak Deviation Same as above, ±180 ±240 mV FEATURES and OPTIONS Emote On/Off Control ® ±180 ±240 mV Negative Logic, ON state ON = Pin grounded or external voltage -0.1 0.8 V Negative Logic, OFF state OFF = Pin open or external voltage 2.5 15 V Control Current open collector/drain 1 2 mA "P" suffix UN = Pin open or external voltage 100 15 V Positive Logic, ON state ON = Pin open or external voltage 0.0 15 V Positive Logic, OFF state OFF = Ground pin or external voltage 10 15 V	GENERAL and SAFETY Efficiency Isolation Isolation Voltage, Input to Output Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety (meets the following requirements) Calculated MTBF	Vin=48V, full load Vin=24V, full load UL-60950-1, CSA-C22.2 No.60950-1, IEC/EN60950-1, 2nd Edition Per Telcordia SR332, issue 1, class 3, ground fixed, Tambient=+25°C	89.5	91 91 00 100 Yes 3.0	325	% Vdc MΩ pF Hours x 10 ⁶
Dynamic Load Response ±1% of Vout 100 200 µSec Dynamic Load Peak Deviation Same as above, ±180 ±240 mV FEATURES and OPTIONS Remote On/Off Control ® "N" suffix Negative Logic, ON state ON = Pin grounded or external voltage -0.1 0.8 V Negative Logic, OFF state OFF = Pin open or external voltage 2.5 15 V Control Current open collector/drain 1 2 mA "P" suffix	GENERAL and SAFETY Efficiency Isolation Isolation Voltage, Input to Output Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety (meets the following requirements) Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency	Vin=48V, full load Vin=24V, full load UL-60950-1, CSA-C22.2 No.60950-1, IEC/EN60950-1, 2nd Edition Per Telcordia SR332, issue 1, class 3, ground fixed, Tambient=+25°C	89.5	91 91 00 100 Yes 3.0		% Vdc MΩ pF Hours x 10 ⁶ KHz
FEATURES and OPTIONS Remote On/Off Control ® "N" suffix Negative Logic, ON state ON = Pin grounded or external voltage -0.1 0.8 V Negative Logic, OFF state OFF = Pin open or external voltage 2.5 15 V Control Current open collector/drain 1 2 mA "P" suffix ON = Pin open or external voltage 10 15 V Positive Logic, OFF state ON = Pin open or external voltage 10 15 V Positive Logic, OFF state OFF = Ground pin or external voltage 0 0.7 V	GENERAL and SAFETY Efficiency Isolation Isolation Voltage, Input to Output Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety (meets the following requirements) Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency	Vin=48V, full load Vin=24V, full load UL-60950-1, CSA-C22.2 No.60950-1, IEC/EN60950-1, 2nd Edition Per Telcordia SR332, issue 1, class 3, ground fixed, Tambient=+25°C Power On to Vout regulated Remote ON to Vout regulated	89.5	91 91 00 100 Yes 3.0	30	% Vdc MΩ pF Hours x 10 ⁶ KHz mS
Remote On/Off Control ® "N" suffix Negative Logic, ON state ON = Pin grounded or external voltage -0.1 0.8 V Negative Logic, OFF state OFF = Pin open or external voltage 2.5 15 V Control Current open collector/drain 1 2 mA "P" suffix	GENERAL and SAFETY Efficiency Isolation Isolation Voltage, Input to Output Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety (meets the following requirements) Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency Startup Time Startup Time	Vin=48V, full load Vin=24V, full load Vin=24V, full load UL-60950-1, CSA-C22.2 No.60950-1, IEC/EN60950-1, 2nd Edition Per Telcordia SR332, issue 1, class 3, ground fixed, Tambient=+25°C Power On to Vout regulated Remote ON to Vout regulated S0-75-50% load step, settling time to within	89.5	91 91 91 100 1000 Yes 3.0 275	30 30	% Vdc MΩ pF Hours x 10 ⁶ KHz mS mS
"N" suffix Negative Logic, ON state ON = Pin grounded or external voltage -0.1 0.8 V Negative Logic, OFF state OFF = Pin open or external voltage 2.5 15 V Control Current open collector/drain 1 2 mA "P" suffix Positive Logic, ON state ON = Pin open or external voltage 10 15 V Positive Logic, OFF state OFF = Ground pin or external voltage 0 0.7 V	GENERAL and SAFETY Efficiency Isolation Isolation Voltage, Input to Output Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety (meets the following requirements) Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency Startup Time Startup Time	Vin=48V, full load Vin=24V, full load Vin=24V, full load UL-60950-1, CSA-C22.2 No.60950-1, IEC/EN60950-1, 2nd Edition Per Telcordia SR332, issue 1, class 3, ground fixed, Tambient=+25°C Power On to Vout regulated Remote ON to Vout regulated S0-75-50% load step, settling time to within ±1% of Vout	89.5	91 91 91 basic 100 1000 Yes 3.0 275 100	30 30 200	% Vdc MΩ pF Hours x 10 ⁶ KHz mS mS μSec
"N" suffix Negative Logic, ON state ON = Pin grounded or external voltage -0.1 0.8 V Negative Logic, OFF state OFF = Pin open or external voltage 2.5 15 V Control Current open collector/drain 1 2 mA "P" suffix Positive Logic, ON state ON = Pin open or external voltage 10 15 V Positive Logic, OFF state OFF = Ground pin or external voltage 0 0.7 V	GENERAL and SAFETY Efficiency Isolation Isolation Voltage, Input to Output Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety (meets the following requirements) Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency Startup Time Startup Time Dynamic Load Response	Vin=48V, full load Vin=24V, full load Vin=24V, full load UL-60950-1, CSA-C22.2 No.60950-1, IEC/EN60950-1, 2nd Edition Per Telcordia SR332, issue 1, class 3, ground fixed, Tambient=+25°C Power On to Vout regulated Remote ON to Vout regulated S0-75-50% load step, settling time to within ±1% of Vout	89.5	91 91 91 basic 100 1000 Yes 3.0 275 100	30 30 200	% Vdc MΩ pF Hours x 10 ⁶ KHz mS mS μSec
Negative Logic, ON state ON = Pin grounded or external voltage -0.1 0.8 V Negative Logic, OFF state OFF = Pin open or external voltage 2.5 15 V Control Current open collector/drain 1 2 mA "P" suffix ON = Pin open or external voltage 10 15 V Positive Logic, OFF state ON = Pin open or external voltage 00 0.7 V	GENERAL and SAFETY Efficiency Isolation Isolation Voltage, Input to Output Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety (meets the following requirements) Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency Startup Time Startup Time Dynamic Load Response Dynamic Load Peak Deviation	Vin=48V, full load Vin=24V, full load Vin=24V, full load UL-60950-1, CSA-C22.2 No.60950-1, IEC/EN60950-1, 2nd Edition Per Telcordia SR332, issue 1, class 3, ground fixed, Tambient=+25°C Power On to Vout regulated Remote ON to Vout regulated S0-75-50% load step, settling time to within ±1% of Vout	89.5	91 91 91 basic 100 1000 Yes 3.0 275 100	30 30 200	% Vdc MΩ pF Hours x 10 ⁶ KHz mS mS μSec
Negative Logic, OFF state OFF = Pin open or external voltage 2.5 15 V Control Current open collector/drain 1 2 mA "P" suffix ON = Pin open or external voltage 10 15 V Positive Logic, OFF state ON = Pin open or external voltage 10 15 V Positive Logic, OFF state OFF = Ground pin or external voltage 0 0.7 V	GENERAL and SAFETY Efficiency Isolation Isolation Voltage, Input to Output Insulation Safety Rating Isolation Notage, Input to Output Insulation Safety Rating Isolation Capacitance Safety (meets the following requirements) Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency Startup Time Startup Time Dynamic Load Response Dynamic Load Peak Deviation FEATURES and OPTIONS Remote On/Off Control (6)	Vin=48V, full load Vin=24V, full load Vin=24V, full load UL-60950-1, CSA-C22.2 No.60950-1, IEC/EN60950-1, 2nd Edition Per Telcordia SR332, issue 1, class 3, ground fixed, Tambient=+25°C Power On to Vout regulated Remote ON to Vout regulated S0-75-50% load step, settling time to within ±1% of Vout	89.5	91 91 91 basic 100 1000 Yes 3.0 275 100	30 30 200	% Vdc MΩ pF Hours x 10 ⁶ KHz mS mS μSec
Control Current open collector/drain 1 2 mA "P" suffix Positive Logic, ON state ON = Pin open or external voltage 10 15 V Positive Logic, OFF state OFF = Ground pin or external voltage 0 0.7 V	GENERAL and SAFETY Efficiency Isolation Isolation Voltage, Input to Output Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety (meets the following requirements) Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency Startup Time Startup Time Dynamic Load Response Dynamic Load Peak Deviation FEATURES and OPTIONS Remote On/Off Control © "N" suffix	Vin=48V, full load Vin=24V, full load UL-60950-1, CSA-C22.2 No.60950-1, IEC/EN60950-1, 2nd Edition Per Telcordia SR332, issue 1, class 3, ground fixed, Tambient=+25°C Power On to Vout regulated Remote ON to Vout regulated 50-75-50% load step, settling time to within ±1% of Vout Same as above,	89.5 2250 225	91 91 91 basic 100 1000 Yes 3.0 275 100	30 30 200 ±240	% Vdc MΩ pF Hours x 10 ⁶ KHz mS mS mS mS mS mV
"P" suffix Positive Logic, ON state ON = Pin open or external voltage 10 15 V Positive Logic, OFF state OFF = Ground pin or external voltage 0 0.7 V	GENERAL and SAFETY Efficiency Isolation Isolation Voltage, Input to Output Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety (meets the following requirements) Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency Startup Time Startup Time Dynamic Load Response Dynamic Load Response Dynamic Load Peak Deviation FEATURES and OPTIONS Remote On/Off Control © "N" suffix Negative Logic, ON state	Vin=48V, full load Vin=24V, full load UL-60950-1, CSA-C22.2 No.60950-1, IEC/EN60950-1, 2nd Edition Per Telcordia SR332, issue 1, class 3, ground fixed, Tambient=+25°C Power On to Vout regulated Remote ON to Vout regulated 50-75-50% load step, settling time to within ±1% of Vout Same as above, ON = Pin grounded or external voltage	89.5 2250 225 225 -0.1	91 91 91 basic 100 1000 Yes 3.0 275 100	30 30 200 ±240 0.8	% Vdc MΩ pF Hours x 10 ⁶ KHz mS mS μSec mV
Positive Logic, ON state ON = Pin open or external voltage 10 15 V Positive Logic, OFF state OFF = Ground pin or external voltage 0 0.7 V	GENERAL and SAFETY Efficiency Isolation Isolation Voltage, Input to Output Insulation Safety Rating Isolation Nesistance Isolation Capacitance Safety (meets the following requirements) Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency Startup Time Dynamic Load Response Dynamic Load Peak Deviation FEATURES and OPTIONS Remote On/Off Control (6) "N" suffix Negative Logic, ON state Negative Logic, OFF state	Vin=48V, full load Vin=24V, full load UL-60950-1, CSA-C22.2 No.60950-1, IEC/EN60950-1, 2nd Edition Per Telcordia SR332, issue 1, class 3, ground fixed, Tambient=+25°C Power On to Vout regulated S0-75-50% load step, settling time to within ±1% of Vout Same as above, ON = Pin grounded or external voltage OFF = Pin open or external voltage	89.5 2250 225 225 -0.1	91 91 91 100 1000 Yes 3.0 275 100 ±180	30 30 200 ±240 0.8 15	% Vdc MΩ pF Hours x 10 ⁶ KHz mS mS wSec mV V
Positive Logic, OFF state OFF = Ground pin or external voltage O 0.7 V	GENERAL and SAFETY Efficiency Isolation Isolation Voltage, Input to Output Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety (meets the following requirements) Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency Startup Time Dynamic Load Response Dynamic Load Peak Deviation FEATURES and OPTIONS Remote On/Off Control © "N" suffix Negative Logic, OFF state Control Current	Vin=48V, full load Vin=24V, full load UL-60950-1, CSA-C22.2 No.60950-1, IEC/EN60950-1, 2nd Edition Per Telcordia SR332, issue 1, class 3, ground fixed, Tambient=+25°C Power On to Vout regulated S0-75-50% load step, settling time to within ±1% of Vout Same as above, ON = Pin grounded or external voltage OFF = Pin open or external voltage	89.5 2250 225 225 -0.1	91 91 91 100 1000 Yes 3.0 275 100 ±180	30 30 200 ±240 0.8 15	% Vdc MΩ pF Hours x 10 ⁶ KHz mS mS wSec mV V
•	GENERAL and SAFETY Efficiency Isolation Isolation Voltage, Input to Output Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety (meets the following requirements) Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency Startup Time Dynamic Load Response Dynamic Load Peak Deviation FEATURES and OPTIONS Remote On/Off Control © "N" suffix Negative Logic, OFF state Control Current "P" suffix	Vin=48V, full load Vin=24V, full load Vin=24V, full load UL-60950-1, CSA-C22.2 No.60950-1, IEC/EN60950-1, 2nd Edition Per Telcordia SR332, issue 1, class 3, ground fixed, Tambient=+25°C Power On to Vout regulated Remote ON to Vout regulated 50-75-50% load step, settling time to within ±1% of Vout Same as above, ON = Pin grounded or external voltage OFF = Pin open or external voltage OFF = Pin open or external voltage	89.5 2250 225 225 -0.1 2.5	91 91 91 100 1000 Yes 3.0 275 100 ±180	30 30 200 ±240 0.8 15 2	% Vdc MΩ pF Hours x 10 ⁶ KHz mS μSec mV V V V M
	GENERAL and SAFETY Efficiency Isolation Isolation Voltage, Input to Output Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety (meets the following requirements) Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency Startup Time Dynamic Load Response Dynamic Load Peak Deviation FEATURES and OPTIONS Remote On/Off Control © "N" suffix Negative Logic, OFF state Control Current "P" suffix Positive Logic, ON state	Vin=48V, full load Vin=24V, full load Vin=24V, full load UL-60950-1, CSA-C22.2 No.60950-1, IEC/EN60950-1, 2nd Edition Per Telcordia SR332, issue 1, class 3, ground fixed, Tambient=+25°C Power On to Vout regulated Remote ON to Vout regulated 50-75-50% load step, settling time to within ±1% of Vout Same as above, ON = Pin grounded or external voltage OFF = Pin open or external voltage ON = Pin open or external voltage ON = Pin open or external voltage	89.5 2250 225 225 -0.1 2.5 -0.1 2.5	91 91 91 100 1000 Yes 3.0 275 100 ±180	30 30 200 ±240 0.8 15 2 15	% Vdc MΩ pF Hours x 10 ⁶ KHz mS μSec mV V V V V V V V V V V

UWS Series

Sixteenth-brick DOSA-Compatible, Wide Input Isolated DC-DC Converters

FUNCTIONAL SPECIFICATIONS, UWS-5/10-Q48 (CONT.)

OUTPUT	Conditions ①	Minimum	Typical/Nominal	Maximum	Units
Total Output Power	See Derating	0.0	50	50.63	W
Voltage	5		-		
Nominal Output Voltage	No trim	4.938	5	5.063	Vdc
Setting Accuracy	At 50% load	-1.25		1.25	% of Vset
Output Voltage Range	User-adjustable	-20		10	
Overvoltage Protection	Via magnetic feedback	6.2	6.4	6.6	Vdc
Current	0				
Output Current Range	Vin=18V to 36V	0		8	
Output Current Range	Vin=36V to 75V	0		10	A
Minimum Load			No minimum load		
Current Limit Inception	98% of Vnom., cold condition	11	13	15.5	A
Short Circuit		1			
Short Circuit Current	Hiccup technique, autorecovery within ±1% of Vout		0.6		A
Short Circuit Duration (remove short for recovery)	Output shorted to ground, no damage		Continuous		
Short circuit protection method	Current limiting				
Regulation 🕖					
Line Regulation	Vin=min. to max., Vout=nom., nom load			±0.125	%
Load Regulation	lout=min. to max			±0.125	%
	With a 1uF 10 uF output caps.		90	130	mV pk-pk
Ripple and Noise (9)	With a 1uF 100uF output caps		65		mV pk-pk
Temperature Coefficient	At all outputs		0.02		% of Vout./°C
Remote Sense Compensation ®	Sense connected at load			10	% of Vout
Maximum Capacitive Loading (10% ceramic, 90% Oscon)	Low ESR	0	5000	-	μF
MECHANICAL					
Outline Dimensions	Cxx case		1.30x0.90x0.36		Inches
(Please refer to outline drawing)	LxWxH		33.0x22.9x9.1		mm
Weight			0.48		Ounces
			13.6		Grams
Through Hole Pin Diameter	Diameter of pins standard		0.040 & 0.060		Inches
			1.02 & 1.52		mm
Through Hole Pin Material			Gold-plated copper alloy with nickel		
	Nister C. C.		underplate		
TH Pin Plating Metal and Thickness	Nickel subplate		50		µ-inches
	Gold overplate		5		µ-inches
EMI/RFI Shielding			none		
ENVIRONMENTAL		40		05	00
Operating Ambient Temperature Range	See derating curves	-40		85	<u> </u>
Storage Temperature	Vin = Zero (no power)	-55		125	
Operating Case Temp	No derating required	-40	105	105	0°C
Thermal Protection/Shutdown	Measured at hotspot	115	125	130	υ
Electromagnetic Interference	External filter is required				01
Conducted, EN55022/CISPR22			B		Class
RoHS rating ④			RoHS-6		

UWS Series



UWS Series



UWS Series



UWS Series

Sixteenth-brick DOSA-Compatible, Wide Input Isolated DC-DC Converters

FUNCTIONAL SPECIFICATIONS, UWS-12/4.5-Q48

ABSOLUTE MAXIMUM RATINGS	Conditions ①	Minimum	Typical/Nominal	Maximum	Units
nput Voltage, Continuous	Full temperature range	0		80	Vdc
nput Voltage, Transient	Operating or non-operating, 100 mS max. duration	0		100	Vdc
solation Voltage	Input to output tested			2250	Vdc
nput Reverse Polarity	None, install external fuse		None		Vdc
In/Off Remote Control	Power on or off, referred to -Vin	0		15	Vdc
Dutput Power		0		54.54	W
Dutput Current	Current-limited, no damage, short-circuit protected	0		4.5	A
Storage Temperature Range	Vin = Zero (no power)	-55		125	°C
Absolute maximums are stress ratings. Exposure isted in the Performance/Functional Specification NPUT	of devices to greater than any of these conditions many and the second time is not implied or recommended.	ay adversely affect lon	g-term reliability. Proper ope	ration under condition	s other than tho
Derating voltage range		18	48	75	Vdc
Recommended External Fuse	Fast blow	10	6	10	A
Start-up threshold	Rising input voltage	16.5	17.2	17.9	Vdc
Indervoltage lockout	Falling input voltage	15	16.5	17.50	Vdc
Dvervoltage shutdown	Rising input voltage		None		Vdc
Reverse Polarity Protection	None, install external fuse		None		Vdc
nternal Filter Type			capacitive		
nput current	·				
Full Load Conditions	Vin = nominal		1.24	1.28	A
Low Line	Vin = minimum , 3.5A load		2.55	2.63	A
Inrush Transient			0.05		A2-Sec.
Output in Short Circuit			100	200	mA
No Load Input Current	lout = minimum, unit=0N		25	60	mA
Shut-Down Mode Input Currrent (Off, UV, OT)			5	10	mA
Reflected (back) ripple current 2	Measured at input with specified filter		30	40	mA, pk-pl
Pre-biased startup	External output voltage < Vset		Monotonic		
GENERAL and SAFETY			· · ·		
Efficiency	Vin=48V, full load	89	91		%
Linciency	Vin=24V, full load	89.5	91.5		%
solation	1				
Isolation Voltage, Input to Output		2250			Vdc
Insulation Safety Rating			basic		_
Isolation Resistance			100		MΩ
Isolation Capacitance			1000		pF
Safety (Designed to meet the following	UL-60950-1, IEC/EN60950-1, 2nd Edition		Yes		
requirements)					
Calculated MTBF ④	Per Telcordia SR332, issue 1, class 3, ground fixed, Tambient=+25°C		3.0		Hours x 10
OYNAMIC CHARACTERISTICS Fixed Switching Frequency		200	000	000	1/11-
Power Up Startup Time	Power On to Vout regulated	200	230	260	KHz
On/Off Startup Time	Remote ON to Vout regulated		++	30	mS mS
Dynamic Load Response	50-75-50% load step, settling time to within $\pm 1\%$ of Vout		250	300	μSec
	Same as above,		±350	±400	mV
Ivnamic Load Peak Deviation					
•					
EATURES and OPTIONS					
EATURES and OPTIONS Remote On/Off Control ©					
EATURES and OPTIONS Remote On/Off Control © 'N" suffix		-0.1		0.8	Vdc
EATURES and OPTIONS Remote On/Off Control © 'N" suffix Negative Logic, ON state	ON=Pin grounded or external voltage	-0.1		0.8	Vdc
EATURES and OPTIONS Remote On/Off Control © 'N" suffix Negative Logic, ON state Negative Logic, OFF state	ON=Pin grounded or external voltage OFF=Pin open or external voltage	-0.1 2.5	1	15	Vdc
EATURES and OPTIONS Remote On/Off Control © 'N" suffix Negative Logic, ON state Negative Logic, OFF state Control Current	ON=Pin grounded or external voltage		1		
FATURES and OPTIONS Remote On/Off Control © 'N" suffix Negative Logic, ON state Negative Logic, OFF state Control Current 'P" suffix	ON=Pin grounded or external voltage OFF=Pin open or external voltage Open collector/drain, sourcing	2.5	1	15 2	Vdc mA
Negative Logic, OFF state	ON=Pin grounded or external voltage OFF=Pin open or external voltage		1	15	Vdc

UWS Series

Sixteenth-brick DOSA-Compatible, Wide Input Isolated DC-DC Converters

FUNCTIONAL SPECIFICATIONS, UWS-12/4.5-Q48 (CONT.)

OUTPUT	Conditions ①	Minimum	Typical/Nominal	Maximum	Units
Total Output Power	See Derating	0.0	54.0	54.54	W
Voltage			-		
Nominal Output Voltage	No trim	11.88	12.00	12.12	Vdc
Setting Accuracy	At 50% load		±1		% of Vnom.
Output Voltage Range	User-adjustable	-20		10	% of Vnom.
Overvoltage Protection	Via magnetic feedback	13.3	15.3	18	Vdc
Current					-
Output Current Range	Vin=18V-36V	0.0		3.5	A
Output Current Range	Vin=36V-75V	0.0		4.5	A
Minimum Load			No minimum load		
Current Limit Inception	98% of Vnom., after warmup	5.05	6.4	7.4	A
Short Circuit					
Short Circuit Current	Hiccup technique, autorecovery within ±1.25% of Vout		0.6		А
Short Circuit Duration (remove short for recovery)	Output shorted to ground, no damage		Continuous		
Short circuit protection method	Current limiting				
Regulation ⑦					
Line Regulation	Vin=min. to max., Vout=nom., full load			±0.125	%
Load Regulation	lout=min. to max., Vin=48V			±0.125	%
Ripple and Noise	with a 1uF 10uF output caps		115	150	mV pk-pk
Temperature Coefficient	At all outputs		±0.02		% of Vnom./°C
Maximum Capacitive Load	Constant resistance mode, low ESR	0	2200		μF
MECHANICAL					
Outline Dimensions	Cxx case		1.30x0.90x0.36		Inches
(Please refer to outline drawing)	LxWxH		33.0x22.9x9.1		mm
Weight			0.48		Ounces
			13.6		Grams
Through Hole Pin Diameter			0.040 & 0.060		Inches
			1.02 & 1.52		mm
Through Hole Pin Material			Copper alloy		
TH Pin Plating Metal and Thickness	Nickel subplate		50		µ-inches
	Gold overplate		5		µ-inches
EMI/RFI Shielding			None		
ENVIRONMENTAL					
Operating Ambient Temperature Range	No derating, full power, natural convection	-40		85	0°
Operating Case Temperature Range	No derating, full power, natural convection	-40		105	<u> </u>
Storage Temperature	Vin = Zero (no power)	-55		125	°C
Thermal Protection/Shutdown	Measured in center	115	125	130	0°
Electromagnetic Interference	External filter is required				
Conducted, EN55022/CISPR22			В		Class
RoHS rating ④			RoHS-6		

UWS Series

Sixteenth-brick DOSA-Compatible, Wide Input Isolated DC-DC Converters

Performance Specification Notes

- All specifications are typical unless noted. Ambient temperature = +25°Celsius, V_{IN} is nominal, output current is maximum rated nominal. External output capacitance is 1 µF multilayer ceramic paralleled with 10 µF electrolytic. All caps are low ESR. These capacitors are necessary for our test equipment and may not be needed in your application. Testing must be kept short enough that the converter does not appreciably heat up during testing. For extended testing, use plenty of airflow. See Derating Curves for temperature performance. All models are stable and regulate within spec without external cacacitance.
- 2. Input Ripple Current is tested and specified over a 5-20 MHz bandwidth and uses a special set of external filters only for the Ripple Current specifications. Input filtering is $C_{IN} = 33 \ \mu\text{F}$, $C_{BUS} = 220 \ \mu\text{F}$, $L_{BUS} = 12 \ \mu\text{H}$. Use capacitor rated voltages which are twice the maximum expected voltage. Capacitors must accept high speed AC switching currents.
- 3. Note that Maximum Current Derating Curves indicate an average current at nominal input voltage. At higher temperatures and/or lower airflow, the converter will tolerate brief full current outputs if the average RMS current over time does not exceed the Derating curve. All Derating curves are presented at sea level altitude. Be aware of reduced power dissipation with increasing density altitude.
- Mean Time Before Failure (MTBF) is calculated using the Telcordia (Belcore) SR-332 Method 1, Case 3, Issue 1, ground fixed conditions. Operating temperature = +30°C, full output load, natural air convection.
- The output may be shorted to ground indefinitely with no damage. The Output Short Circuit Current shown in the specifications is an average consisting of very short bursts of full rated current to test whether the output circuit can be repowered.
- The On/Off Control is normally driven from a switch or relay. An open collector/open drain transistor may be used in saturation and cut-off (pinch-off) modes. External logic may also be used if voltage levels are fully compliant to the specifications.
- Regulation specifications describe the deviation as the input line voltage or output load current is varied from a nominal midpoint value to either extreme (50% load).

- 8. Do not exceed maximum power ratings or output overvoltage when adjusting output trim values.
- 9. At zero output current, Vout may contain components which slightly exceed the ripple and noise specifications.
- 10. Output overload protection is non-latching. When the output overload is removed, the output will automatically recover.
- 11. All models are fully operational and meet published specifications, including "cold start" at -40°C.
- 12. The converter will shut off if the input falls below the undervoltage threshold. It will not restart until the input exceeds the Input Start Up Voltage.
- Short circuit shutdown begins when the output voltage degrades approximately 2% from the selected setting.
- 14. Output noise may be further reduced by installing an external filter. See the Application Notes. Use only as much output filtering as needed <u>and no</u> <u>more</u>. Larger caps (especially low-ESR ceramic types) may slow transient response or degrade dynamic performance. Thoroughly test your application with all components installed.
- 15. To avoid damage or unplanned shutdown, do not sink appreciable reverse output current.
- 16. If reverse polarity is accidentally applied to the input, to ensure reverse input protection with full output load, always connect an external fast blow input fuse in series with the +VN input.
- 17. Although extremely unlikely, failure of the internal components of this product may expose external application circuits to dangerous voltages, currents, temperatures or power levels. Please thoroughly verify all applications before committing them to service. Be sure to include appropriately-rated FUSES (see specifications and Application Notes) to reduce the risk of failure.
- If remote sense is not used, connect it to its respective Vout terminal. Sense is included on UWS-3.3/15-Q48 and UWS-5/10-Q48 models only.
- 19 Output Ripple and Noise for the UWS-5/10-Q48 model with a 1uF and 100uF Tantalum Output Capacitor is 65mVp-p (Typical).

UWS Series



UWS Series

Sixteenth-brick DOSA-Compatible, Wide Input Isolated DC-DC Converters



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UWS Series



UWS Series

Sixteenth-brick DOSA-Compatible, Wide Input Isolated DC-DC Converters

MECHANICAL SPECIFICATIONS, THROUGH-HOLE MOUNT



Material:

Ø .040 Pins: copper alloy
 Ø .060 Pins: copper alloy
 Finish: (all pins)
 Gold (5u"min) over nickel (50u" min)

	INPUT/OUTPUT CONNECTIONS P75					
Pin	Function	Pin	Function			
3	–Vin	4	–Vout			
		5	-Sense*			
2	On/Off Control	6	Output Trim			
		7	+Sense*			
1	+Vin	8	+Vout			

* Sense is included only on models UWS-3.3/15-Q48 and UWS-5/10-Q48. Sense pins are omitted on other models.

Note that some competitive units may use different pin numbering or alternate outline views. However, all units are pinout compatible.

Standard pin length is shown. Please refer to the part number structure for alternate pin lengths.

It is recommended that no parts be placed beneath the converter.

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



Components are shown for reference only and may vary between units.

Recommended Footprint For Thru-hole Converter (View Through Converter)



UWS Series



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Sixteenth-brick DOSA-Compatible, Wide Input Isolated DC-DC Converters

SHIPPING TRAYS AND BOXES, THROUGH-HOLE MOUNT



SHIPPING TRAY DIMENSIONS



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Sixteenth-brick DOSA-Compatible, Wide Input Isolated DC-DC Converters

TECHNICAL NOTES

Input Fusing

Certain applications and/or safety agencies may require the installation of fuses at the inputs of power conversion components. Fuses should also be used if the possibility of sustained, non-current-limited, input-voltage polarity reversals exists. For Murata Power Solutions UWS series DC-DC converters, we recommend the use of a fast blow fuse, installed in the ungrounded input supply line with a typical value about twice the maximum input current, calculated at low line with the converter's minimum efficiency.

All relevant national and international safety standards and regulations must be observed by the installer. For system safety agency approvals, the converters must be installed in compliance with the requirements of the end- use safety standard, i.e. IEC/EN/UL60950-1.

Input Reverse-Polarity Protection

If the input voltage polarity is accidentally reversed, an internal diode will become forward biased and likely draw excessive current from the power source. If this source is not current limited or the circuit appropriately fused, it could cause permanent damage to the converter.

Input Under-Voltage Shutdown and Start-Up Threshold

Under normal start-up conditions, devices will not begin to regulate properly until the ramping-up input voltage exceeds the Start-Up Threshold Voltage. Once operating, devices will not turn off until the input voltage drops below the Under-Voltage Shutdown limit. Subsequent re-start will not occur until the input is brought back up to the Start-Up Threshold. This built in hysteresis prevents any unstable on/off situations from occurring at a single input voltage.

Start-Up Time

The V_{IN} to V_{OUT} Start-Up Time is the time interval between the point at which the ramping input voltage crosses the Start-Up Threshold and the fully loaded output voltage enters and remains within its specified accuracy band. Actual measured times will vary with input source impedance, external input capacitance, and the slew rate and final value of the input voltage as it appears at the converter. The UWS Series implements a soft start circuit to limit the duty cycle of its PWM controller at power up, thereby limiting the input inrush current.

The On/Off Control to Vout start-up time assumes the converter has its nominal input voltage applied but is turned off via the On/Off Control pin. The specification defines the interval between the point at which the converter is turned on (released) and the fully loaded output voltage enters and remains within its specified accuracy band. Similar to the V_{IN} to Vout start-up, the On/Off Control to Vout start-up time is also governed by the internal soft start circuitry and external load capacitance. The difference in start up time from V_{IN} to Vout and from On/Off Control to Vout is therefore insignificant.

Input Source Impedance

The input of UWS converters must be driven from a low ac-impedance source. The DC-DC's performance and stability can be compromised by the use of highly inductive source impedances. The input circuit shown in Figure 2 is a practical solution that can be used to minimize the effects of inductance in the input traces. For optimum performance, components should be mounted close to the DC-DC converter.

I/O Filtering, Input Ripple Current, and Output Noise

All models in the UWS Series are tested/specified for input reflected ripple current and output noise using the specified external input/output components/ circuits and layout as shown in the following two figures. External input capacitors (C_{IN} in Figure 2) serve primarily as energy-storage elements, minimizing line voltage variations caused by transient IR drops in conductors from backplane to the DC-DC. Input caps should be selected for bulk capacitance (at appropriate frequencies), low ESR, and high rms-ripple-current ratings. The switching nature of DC-DC converters requires that dc voltage sources have low ac impedance as highly inductive source impedance can affect system stability. In Figure 2, CBUS and LBUS simulate a typical dc voltage bus. Your specific system configuration may necessitate additional considerations.



Figure 2. Measuring Input Ripple Current

In critical applications, output ripple/noise (also referred to as periodic and random deviations or PARD) may be reduced below specified limits using filtering techniques, the simplest of which is the installation of additional external output capacitors. They function as true filter elements and should be selected for bulk capacitance, low ESR and appropriate frequency response.

All external capacitors should have appropriate voltage ratings and be located as close to the converter as possible. Temperature variations for all relevant parameters should also be taken carefully into consideration. The most effective combination of external I/O capacitors will be a function of line voltage and source impedance, as well as particular load and layout conditions.



Figure 3. Measuring Output Ripple/Noise (PARD)

UWS Series

Floating Outputs

Since these are isolated DC-DC converters, their outputs are "floating" with respect to their input. Designers will normally use the –Output as the ground/ return of the load circuit. You can however, use the +Output as ground/return to effectively reverse the output polarity.

Minimum Output Loading Requirements

UWS converters employ a synchronous-rectifier design topology and all models regulate within spec and are stable under no-load to full load conditions. Operation under no-load conditions however might slightly increase the output ripple and noise.

Thermal Shutdown

The UWS converters are equipped with thermal-shutdown circuitry. If environmental conditions cause the temperature of the DC-DC converter to rise above the designed operating temperature, 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. See Performance/Functional Specifications.

Output Over-Voltage Protection

The UWS output voltage is monitored for an over-voltage condition using a comparator. The signal is optically coupled to the primary side and if the output voltage rises to a level which could be damaging to the load, 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 voltage again climbs to excessive levels, the over-voltage circuitry will initiate another shutdown cycle. This on/off cycling is referred to as "hiccup" mode.

Current Limiting

As soon as the output current increases to approximately 130% of its rated value, 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 somewhat constant power dissipation. This is commonly referred to as power limiting. Current limit inception is defined as the point at which the full-power output voltage falls below the specified tolerance. See Performance/Functional Specifications. If the load current, being drawn from the converter, is significant enough, the unit will go into a short circuit condition as described below.

Short Circuit Condition

When a converter is in current-limit mode, the output voltage 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 voltage to begin ramping to their appropriate value. 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 UWS Series is capable of enduring an indefinite short circuit output condition.

Sixteenth-brick DOSA-Compatible, Wide Input Isolated DC-DC Converters

Remote Sense (models UWS-3.3/15-Q48 and UWS-5/10-Q48 only)

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

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

In cables and discrete wiring applications, twisted pair or other techniques should be used. Output over-voltage protection is monitored at the output voltage pin, not the Sense pin. Therefore, excessive voltage differences between V_{0UT} and Sense in conjunction with trim adjustment of the output voltage can cause the over-voltage protection circuitry to activate (see Performance Specifications for over-voltage 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 over-voltage region. Therefore, the designer must ensure:



Contact and PCB resistance losses due to IR drops

Figure 4. Remote Sense Circuit Configuration Sense is included only on models UWS-3.3/15-Q48 and UWS-5/10-Q48.

UWS Series

Sixteenth-brick DOSA-Compatible, Wide Input Isolated DC-DC Converters

On/Off Control

The input-side, remote On/Off Control function can be ordered to operate with either logic type:

Positive ("P" suffix) logic models are enabled when the On/Off pin is left open or is pulled high (see specifications) with respect to the –Input as per Figure 4. Positive-logic devices are disabled when the on/off pin is pulled low with respect to the –Input.

Negative ("N" suffix) logic devices are off when the On/Off pin is left open or is pulled high (see specifications), and on when the pin is pulled low with respect to the –Input. See specifications.

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. Applying an external voltage to pin 2 when no input power is applied to the converter can cause permanent damage to the converter.







	$5.11 \times \text{Vnom} \times (100 + \Delta\%)$	$-\frac{511}{-10.22}$
$RT_{UP}(k\Omega) =$	1.225 × ∆%	Δ%

Note: " Δ %" is always a positive value. "VNOM" is the nominal, rated output voltage.

"VDES" is the desired, changed output voltage.

OUTPUT VOLTAGE ADJUSTMENT



Sense is included on UWS-3.3/15-D48 and UWS-5/10-Q48. Connect Trim to the respective Vout pin if sense is not installed.

UWS Series



Figure 8. Vertical Wind Tunnel

Through-hole Soldering Guidelines

Murata Power Solutions recommends the TH soldering specifications below when installing these converters. These specifications vary depending on the solder type. Exceeding these specifications may cause damage to the product. Your production environment may differ; therefore please thoroughly review these guidelines with your process engineers.

Wave Solder Operations for throug	Wave Solder Operations for through-hole mounted products (THMT)				
For Sn/Ag/Cu based solders:					
Maximum Preheat Temperature	115° C.				
Maximum Pot Temperature	270° C.				
Maximum Solder Dwell Time 7 seconds					
For Sn/Pb based solders:					
Maximum Preheat Temperature	105° C.				
Maximum Pot Temperature	250° C.				
Maximum Solder Dwell Time	6 seconds				

Murata Power Solutions, Inc.

129 Flanders Road, Westborough, MA 01581 U.S.A. ISO 9001 and 14001 REGISTERED

Sixteenth-brick DOSA-Compatible, Wide Input Isolated DC-DC Converters

Vertical Wind Tunnel

Murata Power Solutions employs a computer controlled customdesigned closed loop vertical wind tunnel, infrared video camera system, and test instrumentation for accurate airflow and heat dissipation analysis of power products. The system includes a precision low flow-rate anemometer, variable speed fan, power supply input and load controls, temperature gauges, and adjustable heating element.

The IR camera monitors the thermal performance of the Unit Under Test (UUT) under static steady-state conditions. A special optical port is used which is transparent to infrared wavelengths.

Both through-hole and surface mount converters are soldered down to a 10" \times 10" host carrier board for realistic heat absorption and spreading. Both longitudinal and transverse airflow studies are possible by rotation of this carrier board since there are often significant differences in the heat dissipation in the two airflow directions. The combination of adjustable airflow, adjustable ambient heat, and adjustable Input/Output currents and voltages mean that a very wide range of measurement conditions can be studied.

The collimator reduces the amount of turbulence adjacent to the UUT by minimizing airflow turbulence. Such turbulence influences the effective heat transfer characteristics and gives false readings. Excess turbulence removes more heat from some surfaces and less heat from others, possibly causing uneven overheating.

Both sides of the UUT are studied since there are different thermal gradients on each side. The adjustable heating element and fan, built-in temperature gauges, and no-contact IR camera mean that power supplies are tested in real-world conditions.

SMT Reflow Soldering Guidelines

The surface-mount reflow solder profile shown below is suitable for SAC305 type leadfree solders. This graph should be used only as a *guideline*. Many other factors influence the success of SMT reflow soldering. Since your production environment may differ, please thoroughly review these guidelines with your process engineers.



This product is subject to the following <u>operating requirements</u> and the <u>Life and Safety Critical Application Sales Policy</u>: Refer to: <u>http://www.murata-ps.com/requirements/</u>

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