

FEATURES

- Small footprint DC/DC converter, ideal for embedded applications
- 1.30" x 0.90" x 0.36" open frame package
- Industry standard DOSA "brick" format and pinout with surface mount option
- 2:1 Input Voltage Range (36V-75V, D48)
- 2250 Volt Basic input/output isolation (48V models)
- Up to 30 Watts total output power with overtemperature shutdown
- High efficiency synchronous rectifier forward topology
- Stable no-load operation with no required external components
- Operating temperature range -40 to +85°C with derating
- Certified to UL/EN/IEC 60950-1, CAN/CSA C22.2 No. 60950-1, EN60950-1 safety approvals, 2nd Edition
- Extensive self-protection shut down features



ULS 30-Watt Series

Sixteenth-brick DOSA-Compatible, Isolated DC/DC Converters

PRODUCT OVERVIEW

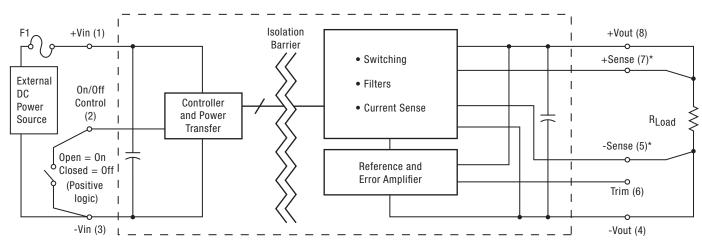
The world of "brick" DC/DC converters has seen a steady size reduction. The ULS series makes another dramatic size shrink down to a "sixteenthbrick" width (0.91 inches) while still retaining up to 30 Watt output and full 2250 Volt DC isolation. The PC-board mount converter family accepts 36 to 75 Volts DC inputs and delivers fixed outputs regulated to within ± 0.125 %. The ULS converters are ideal for datacom and telecom applications, cell phone towers, data centers, server farms and network repeaters.

Typical units

ULS outputs may be trimmed within -20% to +10% of nominal output 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.

Many self-protection features on the ULS series avoid both converter and external circuit hazards. These include input undervoltage lockout and overtemperature shutdown. The outputs 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 rectifier forward topology yields high efficiency for minimal heat buildup and "no fan" operation.



*Sense is included on the ULS-3.3/8-D48 and ULS-5/6-D48 only.

Figure 1. Simplified Block Diagram

Typical topology is shown



https://www.murata-ps.com/support

For full details go to

ULS 30-Watt Series

Discontinued

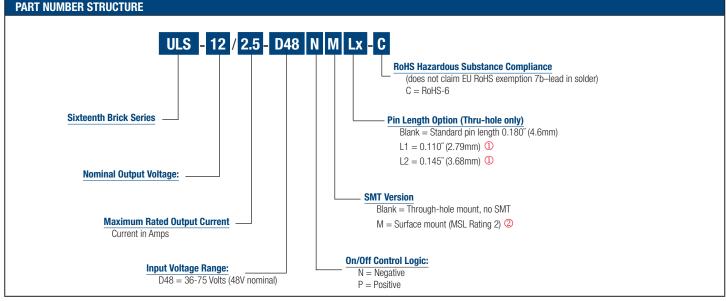
Sixteenth-brick DOSA-Compatible, Isolated DC/DC Converters

				Output				Input		Effici	iency			
Root Model ①	Vout	Іоит	Power	R/N (m)	/ pk-pk)	Regulation	n (max.) ③	VIN Nom.	Range	lın, no load	lın, full		lency	Case (inches)
	(V)	(A, max.)	(W)	Тур.	Max.	Line	Load	(V)	(V)	(mA)	load (A)	Min.	Тур.	
ULS-3.3/8-D48	3.3	8	26.5	90	130	±0.1%	±0.1%	48	36-75	75	0.58	89%	90%	1.30x0.90x0.36
ULS-5/6-D48	5	6	30	75	100	±0.125%	±0.1%	48	36-75	20	0.69	89%	91%	1.30x0.90x0.36
ULS-12/2.5-D48	12	2.5	30	130	150	±0.125%	±0.125%	48	36-75	25	0.71	86%	87.7%	1.30x0.90x0.36
ULS-15/2-D48	15	2	30	115	125	±0.125%	±0.125%	48	36-75	25	0.70	87.5%	89%	1.30x0.90x0.36

① Please refer to the Part Number Structure when ordering.

② All specifications are typical 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 µF electrolytic. 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).



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

ULS 30-Watt Series

Sixteenth-brick DOSA-Compatible, Isolated DC/DC Converters

FUNCTIONAL SPECIFICATIONS, ULS-3.3/8-D48

IEC/EN00950-1, 2nd edition IEC/EN00950-1, 2nd edition Calculated MTBF Per Telcordia SR332, issue 1, class 3, ground fixed, Tambient = +25°C 2 Hours x 10 DYNAMIC CHARACTERISTICS 2 Hours x 10 Hours x 10 Startup Time Power on to Vout regulated 320 350 380 KHz Startup Time Power on to Vout regulated 50 ms Dynamic Load Response 50-75-50% load step, settling time to within 2% of Vout 100 150 µsec Dynamic Load Peak Deviation same as above ±30 ±100 mV	ABSOLUTE MAXIMUM RATINGS	Conditions ①	Minimum	Typical/Nominal	Maximum	Units
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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 2 Hours x 10 DYNAMIC CHARACTERISTICS 2 Hours x 10 Exed Switching Frequency 320 350 380 KHz Startup Time Power on to Vout regulated 50 ms Dynamic Load Response 50-75-50% load step, settling time to within 2% of Vout 100 150 µsec Dynamic Load Peak Deviation same as above ±30 ±100 mV FEATURES and OPTIONS ""* suffix: " V Max Max Negative Logic, OF State ON = Ground pin or external voltage -0.7 1.2 V Negative Logic, ON state ON = Ground pin or external voltage 10 15 V Control Current Open collector/drain 1 mA "P" suffix: Positive Logic, ON state ON = Plin open or external voltage -0.7 1.2 V Control Current OP = Conend pin or external voltage -0.7			10	1000		
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Calculated With fixed, Tambient = +25°C 2 Hours X to DYNAMIC CHARACTERISTICS 50 380 KHz Fixed Switching Frequency 320 350 380 KHz Startup Time Power on to Vout regulated 50 ms Dynamic Load Response 50-75-50% load step, settling time to within 2% of Vout 100 150 µsec Dynamic Load Peak Deviation same as above ±30 ±100 mV FEATURES and OPTIONS ************************************	Isolation Capacitance	Cartified to LIL 60050 1 CSA C22 2 No. 60050 1				
Trixed, lambient = +25°C Image: constraint of the second	Isolation Capacitance Safety	IEC/EN60950-1, 2nd edition		Yes		
Fixed Switching Frequency320350380KHzStartup TimePower on to Vout regulated50msStartup TimeRemote ON to Vout regulated50msOpnamic Load Response50-75-50% load step, settling time to within 2% of Vout100150µsecDynamic Load Peak Deviationsame as above±30±100mVEEATURES and OPTIONSRemote On/Off Control ©"N" suffix:1001.2VNegative Logic, ON stateON = Ground pin or external voltage10150VControl Current0FF = Pin open or external voltage10150VPositive Logic, ON stateON = Pin open or external voltage10150VPositive Logic, ON stateON = Pin open or external voltage10150VPositive Logic, OFF stateOFF = Pin open or external voltage10150VPositive Logic, OFF stateOFF = Ground pin or external voltage10150VPositive Logic, OFF stateOFF = Ground pin or external voltage10150VPositive Logic, OFF stateOFF = Ground pin or external voltage0.71.2VControl CurrentOPF = Ground pin or external voltage0.71.2VPositive Logic, OFF stateOFF = Ground pin or external voltage0.71.2VControl CurrentOpen collector/drain1mAmA	Safety	IEC/EN60950-1, 2nd edition Per Telcordia SR332, issue 1, class 3, ground				Hours x 10 ^e
Startup TimePower on to Vout regulated50msStartup TimeRemote ON to Vout regulated50msDynamic Load Response $50-75-50\%$ load step, settling time to within 2% of Vout100150µsecDynamic Load Peak Deviationsame as above ± 30 ± 100 mVFEATURES and OPTIONSRemote On/Off Control ©"N" suffix:Negative Logic, ON stateON = Ground pin or external voltage-0.71.2VNegative Logic, OFF stateOFF = Pin open or external voltage101mA"P" suffix:ON = Pin open or external voltage1015VPositive Logic, ON stateON = Pin open or external voltage1015VPositive Logic, ON stateON = Pin open or external voltage1015VPositive Logic, OFF stateON = Pin open or external voltage1015VPositive Logic, OFF stateON = Pin open or external voltage1015VPositive Logic, OFF stateOFF = Ground pin or external voltage1015VPositive Logic, OFF stateOFF = Ground pin or external voltage-0.71.2VOpen collector/drain1mAOpen collector/drain1mA	Safety Calculated MTBF	IEC/EN60950-1, 2nd edition Per Telcordia SR332, issue 1, class 3, ground				Hours x 10 ⁶
Startup TimeRemote ON to Vout regulated50msDynamic Load Response50-75-50% load step, settling time to within 2% of Vout100150µsecDynamic Load Peak Deviationsame as above±30±100mVFEATURES and OPTIONSRemote On/Off Control ©"N" suffix:Negative Logic, ON stateON = Ground pin or external voltage-0.71.2VNegative Logic, OFF stateOPF = Pin open or external voltage101mA"P" suffix:Positive Logic, ON stateON = Ground pin or external voltage101mA"P" suffix:Positive Logic, OFF stateON = Pin open or external voltage1015VPositive Logic, ON stateON = Pin open or external voltage1015VPositive Logic, OFF stateOFF = Ground pin or external voltage-0.71.2VPositive Logic, OFF stateOFF = Ground pin or external voltage1015VPositive Logic, OFF stateOFF = Ground pin or external voltage-0.71.2V	Safety Calculated MTBF DYNAMIC CHARACTERISTICS	IEC/EN60950-1, 2nd edition Per Telcordia SR332, issue 1, class 3, ground	200	2	200	
Dynamic Load Response 50-75-50% load step, settling time to within 2% of Vout 100 150 µsec Dynamic Load Peak Deviation same as above ±30 ±100 mV FEATURES and OPTIONS Remote On/Off Control © "N" suffix: Negative Logic, ON state ON = Ground pin or external voltage -0.7 1.2 V Negative Logic, OFF state OFF = Pin open or external voltage 10 1 mA "P" suffix: Open collector/drain 1 mA MA Positive Logic, ON state ON = Pin open or external voltage 10 15. V Positive Logic, ON state ON = Pin open or external voltage 10 15. V Positive Logic, OFF state OFF = Ground pin or external voltage 10 12. V Positive Logic, OFF state OFF = Ground pin or external voltage -0.7 1.2 V Control Current Open collector/drain 1 mA	Safety Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency	IEC/EN60950-1, 2nd edition Per Telcordia SR332, issue 1, class 3, ground fixed, Tambient = +25°C	320	2		KHz
Opnamic Load Response of Vout 100 150 psec Opnamic Load Response it 00 it 50 it 50 psec Opnamic Load Peak Deviation same as above ±30 ±100 mV FEATURES and OPTIONS #30 ±100 mV Remote On/Off Control © "N" suffix: Negative Logic, ON state ON = Ground pin or external voltage -0.7 1.2 V Negative Logic, OFF state OPen collector/drain 1 mA mA "P" suffix:	Safety Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency Startup Time	IEC/EN60950-1, 2nd edition Per Telcordia SR332, issue 1, class 3, ground fixed, Tambient = +25°C Power on to Vout regulated	320	2	50	KHz ms
FEATURES and OPTIONS Remote On/Off Control ③ "N" suffix:	Safety Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency Startup Time	IEC/EN60950-1, 2nd edition Per Telcordia SR332, issue 1, class 3, ground fixed, Tambient = +25°C Power on to Vout regulated Power on to Vout regulated Remote ON to Vout regulated	320	2	50	KHz ms
Remote On/Off Control © "N" suffix: Negative Logic, ON state ON = Ground pin or external voltage -0.7 1.2 V Negative Logic, OFF state OFF = Pin open or external voltage 10 15 V Control Current Open collector/drain 1 mA "P" suffix: Positive Logic, ON state 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 10 12 V Positive Logic, OFF state OFF = Ground pin or external voltage -0.7 1.2 V Positive Logic, OFF state OFF = Ground pin or external voltage -0.7 1.2 V	Safety Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency Startup Time Startup Time	IEC/EN60950-1, 2nd edition Per Telcordia SR332, issue 1, class 3, ground fixed, Tambient = +25°C Power on to Vout regulated Power on to Vout regulated Remote ON to Vout regulated 50-75-50% load step, settling time to within 2%	320	2 350	50 50	KHz ms ms
"N" suffix: Negative Logic, ON state ON = Ground pin or external voltage -0.7 1.2 V Negative Logic, OFF state OFF = Pin open or external voltage 10 15 V Control Current Open collector/drain 1 mA "P" suffix: Positive Logic, OFF state 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 10 15 V Positive Logic, OFF state OFF = Ground pin or external voltage -0.7 1.2 V Control Current Open collector/drain 1 mA	Safety Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency Startup Time Startup Time Dynamic Load Response Dynamic Load Peak Deviation	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 2% of Vout	320	2 350 100	50 50 150	KHz ms ms µsec
Negative Logic, ON state ON = Ground pin or external voltage -0.7 1.2 V Negative Logic, OFF state OFF = Pin open or external voltage 10 15 V Control Current Open collector/drain 1 mA "P" suffix: Positive Logic, OFF state 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 -0.7 1.2 V Control Current Open collector/drain 1 mA	Safety Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency Startup Time Startup Time Dynamic Load Response Dynamic Load Peak Deviation FEATURES and OPTIONS	IEC/EN60950-1, 2nd edition Per Telcordia SR332, issue 1, class 3, ground fixed, Tambient = +25°C Power on to Vout regulated Power on to Vout regulated Remote ON to Vout regulated 50-75-50% load step, settling time to within 2% of Vout	320	2 350 100	50 50 150	KHz ms ms µsec
Negative Logic, OFF state OFF = Pin open or external voltage 10 15 V Control Current Open collector/drain 1 mA "P" suffix: Positive Logic, ON state 0N = 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 -0.7 1.2 V Control Current Open collector/drain 1 mA	Safety 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 (S)	IEC/EN60950-1, 2nd edition Per Telcordia SR332, issue 1, class 3, ground fixed, Tambient = +25°C Power on to Vout regulated Power on to Vout regulated Remote ON to Vout regulated 50-75-50% load step, settling time to within 2% of Vout	320	2 350 100	50 50 150	KHz ms ms µsec
Control Current Open collector/drain 1 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 -0.7 1.2 V Control Current Open collector/drain 1 mA	Safety 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:	IEC/EN60950-1, 2nd edition Per Telcordia SR332, issue 1, class 3, ground fixed, Tambient = +25°C Power on to Vout regulated Power on to Vout regulated S0-75-50% load step, settling time to within 2% of Vout same as above		2 350 100	50 50 150 ±100	KHz ms ms μsec 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 -0.7 1.2 V Control Current Open collector/drain 1 mA	Safety Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency Startup Time Startup Time Oynamic Load Response Dynamic Load Peak Deviation FEATURES and OPTIONS Remote On/Off Control © "N" suffix: Negative Logic, ON state	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 2% of Vout same as above ON = Ground pin or external voltage	-0.7	2 350 100	50 50 150 ±100	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 -0.7 1.2 V Control Current Open collector/drain 1 mA	Safety 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: Negative Logic, ON state Negative Logic, OFF state	IEC/EN60950-1, 2nd edition Per Telcordia SR332, issue 1, class 3, ground fixed, Tambient = +25°C Power on to Vout regulated Power on to Vout regulated S0-75-50% load step, settling time to within 2% of Vout same as above ON = Ground pin or external voltage OFF = Pin open or external voltage	-0.7	2 350 100	50 50 150 ±100	KHz ms ms μsec mV
Positive Logic, OFF state OFF = Ground pin or external voltage -0.7 1.2 V Control Current Open collector/drain 1 mA	Safety 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: Negative Logic, ON state Negative Logic, OFF state Control Current	IEC/EN60950-1, 2nd edition Per Telcordia SR332, issue 1, class 3, ground fixed, Tambient = +25°C Power on to Vout regulated Power on to Vout regulated S0-75-50% load step, settling time to within 2% of Vout same as above ON = Ground pin or external voltage OFF = Pin open or external voltage	-0.7	2 350 100 ±30	50 50 150 ±100	KHz ms ms µsec mV V V
Control Current Open collector/drain 1 mA	Safety 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: Negative Logic, ON state Negative Logic, OFF state Control Current "P" suffix:	IEC/EN60950-1, 2nd edition Per Telcordia SR332, issue 1, class 3, ground fixed, Tambient = +25°C Power on to Vout regulated Power on to Vout regulated S0-75-50% load step, settling time to within 2% of Vout same as above ON = Ground pin or external voltage OFF = Pin open or external voltage Open collector/drain	-0.7	2 350 100 ±30	50 50 150 ±100	KHz ms ms µsec mV V V
	Safety 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 (3) "N" suffix: Negative Logic, ON state Negative Logic, OFF state Control Current "P" suffix: Positive Logic, ON state	IEC/EN60950-1, 2nd edition Per Telcordia SR332, issue 1, class 3, ground fixed, Tambient = +25°C Power on to Vout regulated Power on to Vout regulated S0-75-50% load step, settling time to within 2% of Vout Same as above ON = Ground pin or external voltage OFF = Pin open or external voltage ON = Pin open or external voltage	-0.7 10	2 350 100 ±30	50 50 150 ±100 1.2 15 15	KHz ms ms µsec mV V V wA
SMT Mounting "M" suffix	Safety 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 ③ "N" suffix: Negative Logic, ON state Negative Logic, OFF state Control Current "P" suffix: Positive Logic, ON state Positive Logic, ON state Positive Logic, OFF state	IEC/EN60950-1, 2nd edition Per Telcordia SR332, issue 1, class 3, ground fixed, Tambient = +25°C Power on to Vout regulated Power on to Vout regulated S0-75-50% load step, settling time to within 2% of Vout Same as above ON = Ground pin or external voltage OFF = Pin open or external voltage ON = Pin open or external voltage ON = Pin open or external voltage ON = Fin open or external voltage OFF = Ground pin or external voltage	-0.7 10 10	2 350 100 ±30	50 50 150 ±100 1.2 15 15	KHz ms ms μsec mV V V mA
	Safety 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 ③ "N" suffix: Negative Logic, ON state Negative Logic, OFF state Control Current "P" suffix: Positive Logic, OFF state Positive Logic, OFF state Control Current	IEC/EN60950-1, 2nd edition Per Telcordia SR332, issue 1, class 3, ground fixed, Tambient = +25°C Power on to Vout regulated Power on to Vout regulated 50-75-50% load step, settling time to within 2% of Vout Same as above ON = Ground pin or external voltage OFF = Pin open or external voltage OPF = Pin open or external voltage ON = Pin open or external voltage OFF = Ground pin or external voltage OFF = Ground pin or external voltage	-0.7 10 10	2 350 100 ±30 1	50 50 150 ±100 1.2 15 15	KHz ms ms µsec mV V V v mA

ULS 30-Watt Series

Sixteenth-brick DOSA-Compatible, Isolated DC/DC Converters

FUNCTIONAL SPECIFICATIONS, ULS-3.3/8-D48 (CONT.)

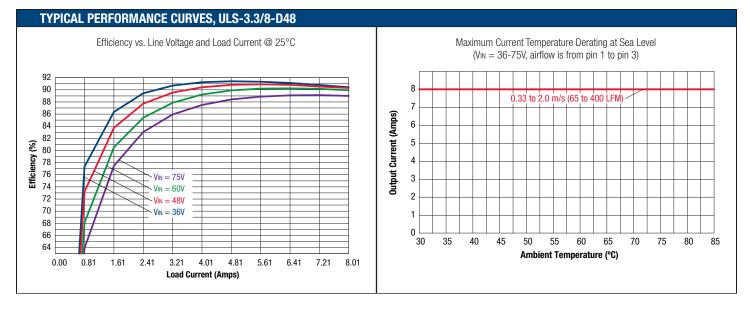
OUTPUT	Conditions ①	Minimum	Typical/Nominal	Maximum	Units
Total Output Power	See Derating	2.61	25	26.66	W
Voltage					
Nominal Output Voltage	No trim	3.2674	3.3	3.333	Vdc
Setting Accuracy	At 50% load, no trim	-1		1	% of Vnom
Output Voltage Range	User-adjustable	-10		10	% of Vnom.
Overvoltage Protection	Via magnetic feedback	4.2	5	5.7	Vdc
Current					
Output Current Range		0.8	8	8	A
Minimum Load					
Current Limit Inception	98% of Vnom., after warmup	8.5	10	11.3	A
Short Circuit					
Short Circuit Current	Hiccup technique, autorecovery within ±1.25% of Vout			0.3	mA
Short Circuit Duration (remove short for recovery)	Output shorted to ground, no damage		Continuous		
Short circuit protection method	Current limiting				
Regulation ©	J		· · ·		·
Line Regulation	Vin = min. to max., Vout = nom., lout = nom.			±0.1	% of Vout
Load Regulation	lout = min. to max., Vin = 48V			±0.1	% of Vout
Ripple and Noise	5 Hz- 20 MHz BW		90	130	mV pk-pk
Temperature Coefficient	At all outputs		±0.02		% of Vout./°C
Maximum Capacitive Loading	Low ESR, resistive load only			2000	μF
MECHANICAL (Through Hole Models)	Conditions ①③				
Outline Dimensions			1.30x0.90x0.36		Inches
(Please refer to outline drawing)	LxWxH		33.02x22.86x9.144		mm
Weight			0.58		Ounces
•			16.4		Grams
Through Hole Pin Diameter			0.04 & 0.062		Inches
-			1.016 & 1.575		mm
Through Hole Pin Material			Copper alloy		
TH Pin Plating Metal and Thickness	Nickel subplate		50		µ-inches
	Gold overplate		5		µ-inches
ENVIRONMENTAL					
Operating Ambient Temperature Range	With Derating	-40		85	°C
Operating Case Temperature Range	No derating, full power, 200lfm, Vertical mount	-40		70	°C
Storage Temperature	Vin = Zero (no power)	-55		125	°C
Thermal Protection/Shutdown	Measured in center	110	115	120	°C
Electromagnetic Interference	External filter is required				
Conducted, EN55022/CISPR22			В		Class
Radiated, EN55022/CISPR22			В		Class
Relative humidity, non-condensing	To +85°C	10		90	%RH
Altitude	must derate -1%/1000 feet	-500		10,000	feet
		-152		3048	meters
RoHS rating ④			RoHS-6		

Performance Specification Notes

- ① Unless otherwise noted, all specifications are typical at nominal input voltage, nominal output volt age and full load. General conditions are +25° Celsius ambient temperature, near sea level altitude, natural convection airflow. All models are tested and specified with external parallel 1 µF and 10 µF multi-layer ceramic output capacitors. The external input capacitor is 22 µF ceramic. All capacitors re 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.
- @ Input (back) ripple current is tested and specified over 5 Hz to 20 MHz bandwidth. Input filtering is Cbus = 220 μ F/100V, Cin = 33 μ F/100V and Lbus = 12 μ H.
- ③ All models are stable and regulate to specification under no load.
- Reduction of Hazardous Substances (RoHS) compliance is to RoHS-6 (six substances restricted includ-ing lead). See specifications.
- ⑤ The Remote On/Off Control is referred to -Vin.
- Regulation specifications describe the output voltage changes as the line voltage or load current is varied from its nominal or midpoint value to either extreme.

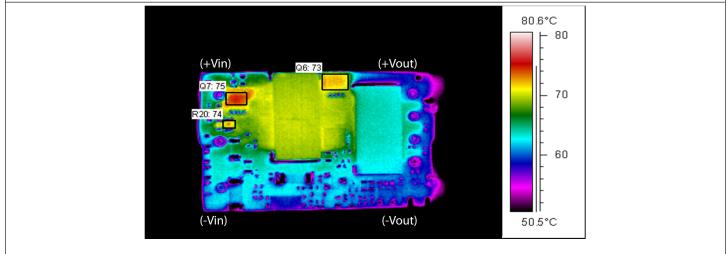
ULS 30-Watt Series

Sixteenth-brick DOSA-Compatible, Isolated DC/DC Converters

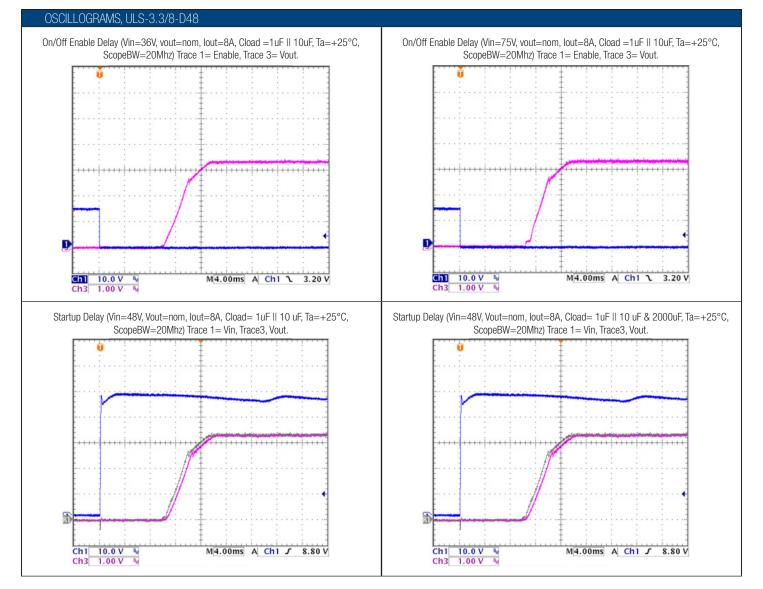


INFRARED THERMAL IMAGE, ULS-3.3/8-D48

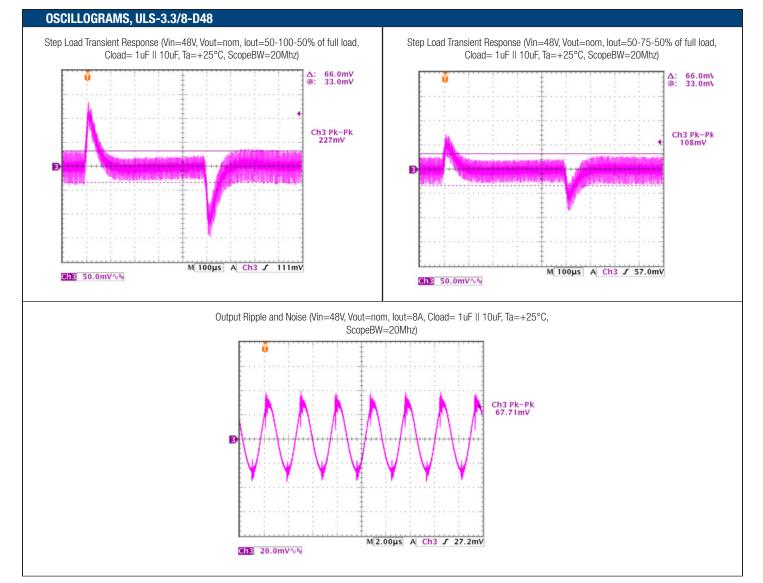
Thermal image with hot spot at full load current with 25°C ambient temperature. Natural convention is used with no forced airflow. Identifiable and recommended maximum value to be verified in application. Vin=48V, Q7 max temp=120°C/IPC9592 guidelines.







ULS 30-Watt Series



ULS 30-Watt Series

Sixteenth-brick DOSA-Compatible, Isolated DC/DC Converters

FUNCTIONAL SPECIFICATIONS, ULS-5/6-D48

ABSOLUTE MAXIMUM RATINGS	Conditions ①	Minimum	Typical/Nominal	Maximum	Units
Input Voltage, Continuous		0		80	Vdc
Input Voltage, Transient	100 mS max. duration	-		100	Vdc
Isolation Voltage	Input to output, continuous			2250	Vdc
Input Reverse Polarity	None, install external fuse		None		Vdc
On/Off Remote Control	Power on, referred to -Vin	0		15	Vdc
Output Power		0		30.3	W
Output Current	Current-limited, no damage, short-circuit protected	0		6	A
Storage Temperature Range	Vin = Zero (no power)	-55		125	°C
Absolute maximums are stress ratings. Exposure of	f devices to greater than any of these conditions may a	dversely affect long-term	reliability. Proper operation	under conditions other th	an those listed in
the Performance/Functional Specifications Table is					
INPUT	Conditions ① ③				
Operating voltage range		36	48	75	Vdc
Recommended External Fuse	Fast blow			2	A
Start-up threshold	Rising input voltage	32.5	35	35.9	Vdc
Undervoltage shutdown	Falling input voltage	31	33.5	34	Vdc
Turn-On/Turn-Off Hysteresis		1.62	1.67	1.72	Vdc
Overvoltage shutdown			None		Vdc
Reverse Polarity Protection	None, install external fuse		None		Vdc
Internal Filter Type			LC		
Input current					1 .
Full Load Conditions	Vin = nominal		0.69	0.71	A
Low Line	Vin = minimum		0.92	0.95	A
Inrush Transient			0.05		A ² -Sec.
Output in Short Circuit			10	100	mA
No Load	lout = minimum, unit = ON		20	60	mA
Shut-Down Input Current (Off, UV, OT)			1	3	mA
Reflected (back) ripple current ②	Measured at input with specified filter		30		mA, p-p
GENERAL and SAFETY					
	Via 40V full land	00	01		0/
Efficiency	Vin = 48V, full load Vin = min., full load	<u>89</u> 89	91 91		%
	Vin = 48V, full load Vin = min., full load				
Efficiency Isolation					
Efficiency	Vin = min., full load	89			%
Efficiency Isolation Isolation Voltage	Vin = min., full load	89	91		%
Efficiency Isolation Isolation Voltage Insulation Safety Rating	Vin = min., full load	89	91 basic		% Vdc
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance	Vin = min., full load	89	91 basic 10		% Vdc ΜΩ
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance	Vin = min., full load Input to output, continuous Certified to UL-60950-1, CSA-C22.2 No. 60950-1, IEC/EN60950-1, 2nd edition Per Telcordia SR332, issue 1, class 3, ground	89	91 basic 10 3300		% Vdc ΜΩ
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety	Vin = min., full load Input to output, continuous Certified to UL-60950-1, CSA-C22.2 No. 60950-1, IEC/EN60950-1, 2nd edition	89	91 basic 10 3300 Yes		% Vdc MΩ pF
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety Calculated MTBF	Vin = min., full load Input to output, continuous Certified to UL-60950-1, CSA-C22.2 No. 60950-1, IEC/EN60950-1, 2nd edition Per Telcordia SR332, issue 1, class 3, ground	89	91 basic 10 3300 Yes	385	% Vdc MΩ pF
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety Calculated MTBF DYNAMIC CHARACTERISTICS	Vin = min., full load Input to output, continuous Certified to UL-60950-1, CSA-C22.2 No. 60950-1, IEC/EN60950-1, 2nd edition Per Telcordia SR332, issue 1, class 3, ground	89 2250	91 basic 10 3300 Yes TBD	<u>385</u> 40	% Vdc MΩ pF Hours x 10 ⁶
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency	Vin = min., full load Input to output, continuous Certified to 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 2250	91 basic 10 3300 Yes TBD 355		% Vdc pF Hours x 10 ⁶
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency Startup Time Startup Time Dynamic Load Response	Vin = min., full load Input to output, continuous Certified to 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	89 2250	91 basic 10 3300 Yes TBD 355 10	40	% Vdc pF Hours x 10 ⁶ KHz mS
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency Startup Time Startup Time	Vin = min., full load Input to output, continuous Certified to 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%	89 2250	91 basic 10 3300 Yes TBD 355 10 10 10	40 40	% Vdc pF Hours x 10 ⁶ KHz mS mS
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency Startup Time Startup Time Dynamic Load Response	Vin = min., full load Input to output, continuous Certified to 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 2250	91 basic 10 3300 Yes TBD 355 10 10 10 75	40 40	% Vdc pF Hours x 10 ⁶ KHz mS mS μSec
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency Startup Time Startup Time Dynamic Load Response Dynamic Load Peak Deviation	Vin = min., full load Input to output, continuous Certified to 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 2250	91 basic 10 3300 Yes TBD 355 10 10 10 75	40 40	% Vdc pF Hours x 10 ⁶ KHz mS mS μSec
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency Startup Time Startup Time Dynamic Load Response Dynamic Load Peak Deviation FEATURES and OPTIONS	Vin = min., full load Input to output, continuous Certified to 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 2250	91 basic 10 3300 Yes TBD 355 10 10 10 75	40 40	% Vdc pF Hours x 10 ⁶ KHz mS mS μSec
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety 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 ©	Vin = min., full load Input to output, continuous Certified to 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 2250	91 basic 10 3300 Yes TBD 355 10 10 10 75	40 40	% Vdc pF Hours x 10 ⁶ KHz mS mS μSec
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety 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 = min., full load Input to output, continuous Certified to 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 same as above ON = Ground pin or external voltage	89 2250 325	91 basic 10 3300 Yes TBD 355 10 10 10 75	40 40 100	% Vdc pF Hours x 10 ⁶ KHz mS mS μSec mV
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety 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: Negative Logic, ON state	Vin = min., full load Input to output, continuous Certified to 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 same as above	89 2250 325 -0.1	91 basic 10 3300 Yes TBD 355 10 10 10 75	40 40 100	% Vdc pF Hours x 10 ⁶ KHz mS mS μSec mV
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety 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 Negative Logic, OFF state	Vin = min., full load Input to output, continuous Certified to 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 Same as above ON = Ground pin or external voltage OFF = Pin open or external voltage	89 2250 325 -0.1	91 basic 10 3300 Yes TBD 355 10 10 10 75 ±150	40 40 100	% Vdc pF Hours x 10 ⁶ KHz mS mS μSec mV
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency Startup Time Dynamic Load Response 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 = min., full load Input to output, continuous Certified to 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 Same as above ON = Ground pin or external voltage OFF = Pin open or external voltage	89 2250 325 -0.1	91 basic 10 3300 Yes TBD 355 10 10 10 75 ±150	40 40 100	% Vdc pF Hours x 10 ⁶ KHz mS mS μSec mV
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety 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: Negative Logic, ON state Negative Logic, OFF state Control Current	Vin = min., full load Input to output, continuous Input to output, continuous Certified to 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 same as above ON = Ground pin or external voltage OFF = Pin open or external voltage Open collector/drain	89 2250 325 -0.1 2.5	91 basic 10 3300 Yes TBD 355 10 10 10 75 ±150	40 40 100 0.8 15	% Vdc pF Hours x 10 ⁶ KHz mS mS μSec mV V V V
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency Startup Time Dynamic Load Response 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 = min., full load Input to output, continuous Input to output, continuous Certified to 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 = Ground pin or external voltage OFF = Pin open or external voltage OPen collector/drain ON = Pin open or external voltage	89 2250 325 -0.1 2.5 10	91 basic 10 3300 Yes TBD 355 10 10 10 75 ±150	40 40 100 0.8 15 15	% Vdc pF Hours x 10 ⁶ KHz mS mS μSec mV V V V
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency Startup Time Dynamic Load Response 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 Positive Logic, OFF state	Vin = min., full load Input to output, continuous Input to output, continuous Certified to 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 = Ground pin or external voltage OFF = Pin open or external voltage ON = Pin open or external voltage	89 2250 325 -0.1 2.5 10	91 basic 10 3300 Yes TBD 355 10 10 10 75 ±150 1 1	40 40 100 0.8 15 15	% Vdc MΩ pF Hours x 10 ⁶ KHz mS μSec mV V

ULS 30-Watt Series

Sixteenth-brick DOSA-Compatible, Isolated DC/DC Converters

FUNCTIONAL SPECIFICATIONS, ULS-5/6-D48 (CONT.)

OUTPUT	Conditions ①	Minimum	Typical/Nominal	Maximum	Units
Total Output Power		0	30	30.3	W
Voltage	· · · ·				
Nominal Output Voltage	No trim	4.95	5	5.05	Vdc
Setting Accuracy	At 50% load, no trim	-1		1	% of Vnom
Output Voltage Range	User-adjustable	-10		10	% of Vnom.
Overvoltage Protection	Via magnetic feedback	6	6.5	7.2	Vdc
Current	· · · · ·				
Output Current Range		0	6	6	A
Minimum Load					
Current Limit Inception	98% of Vnom., after warmup	6.5	7.5	8.25	A
Short Circuit			1		
Short Circuit Current	Hiccup technique, autorecovery within ±1.25% of Vout			0.3	А
Short Circuit Duration (remove short for recovery)	Output shorted to ground, no damage		Continuous		
Short circuit protection method	Current limiting				
Regulation 6					
Line Regulation	Vin = min. to max., Vout = nom., lout = nom.			±0.125	% of Vout
Load Regulation	lout = min. to max., Vin = 48V			±0.1	% of Vout
Ripple and Noise	5 Hz- 20 MHz BW		75	100	mV pk-pk
Temperature Coefficient	At all outputs		±0.02		% of Vout./°C
Maximum Capacitive Loading	Low ESR, resistive load only			2000	μF
MECHANICAL (Through Hole Models)	Conditions ①③				
Outline Dimensions			1.30x0.90x0.36		Inches
(Please refer to outline drawing)	LxWxH		33.02x22.86x9.144		mm
Weight			0.58		Ounces
•			16.4		Grams
Through Hole Pin Diameter			0.04 & 0.062		Inches
			1.016 & 1.575		mm
Through Hole Pin Material			Copper alloy		
TH Pin Plating Metal and Thickness	Nickel subplate		50		µ-inches
-	Gold overplate		5		µ-inches
ENVIRONMENTAL					
Operating Ambient Temperature Range	With Derating	-40		85	°C
Operating Case Temperature Range	No derating, full power, 200lfm, Vertical mount	-40		70	°C
Storage Temperature	Vin = Zero (no power)	-55		125	°C
Thermal Protection/Shutdown	Measured in center	110	115	120	°C
Electromagnetic Interference	External filter is required				
Conducted, EN55022/CISPR22			В		Class
Radiated, EN55022/CISPR22			В		Class
RoHS rating ④			RoHS-6		

Performance Specification Notes

Unless otherwise noted, all specifications are typical at nominal input voltage, nominal output voltage and full load. General conditions are $+25^{\circ}$ Celsius ambient temperature, near sea level altitude, natural convection airflow. All models are tested and specified with external parallel 1 μ F and 10 μ F multi-layer ceramic output capacitors. The external input capacitor is 22 μ F ceramic. 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.

Input (back) ripple current is tested and specified over 5 Hz to 20 MHz bandwidth. Input filtering is Cbus = $220 \ \mu\text{F}/100\text{V}$, Cin = $33 \ \mu\text{F}/100\text{V}$ and Lbus = $12 \ \mu\text{H}$.

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

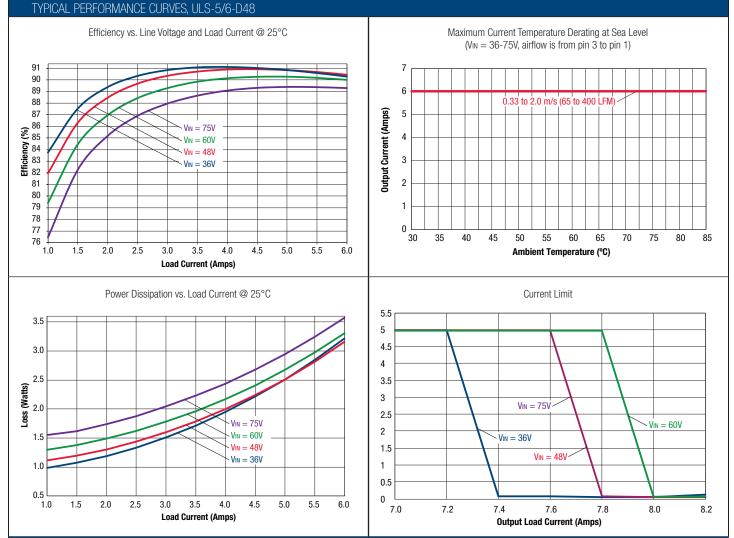
Reduction of Hazardous Substances (RoHS) compliance is to RoHS-6 (six substances restricted including lead). See specifications.

The Remote On/Off Control is referred to -Vin.

Regulation specifications describe the output voltage changes as the line voltage or load current is varied from its nominal or midpoint value to either extreme.

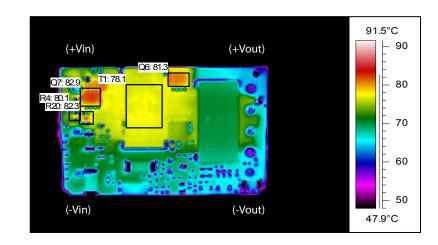
ULS 30-Watt Series

Sixteenth-brick DOSA-Compatible, Isolated DC/DC Converters

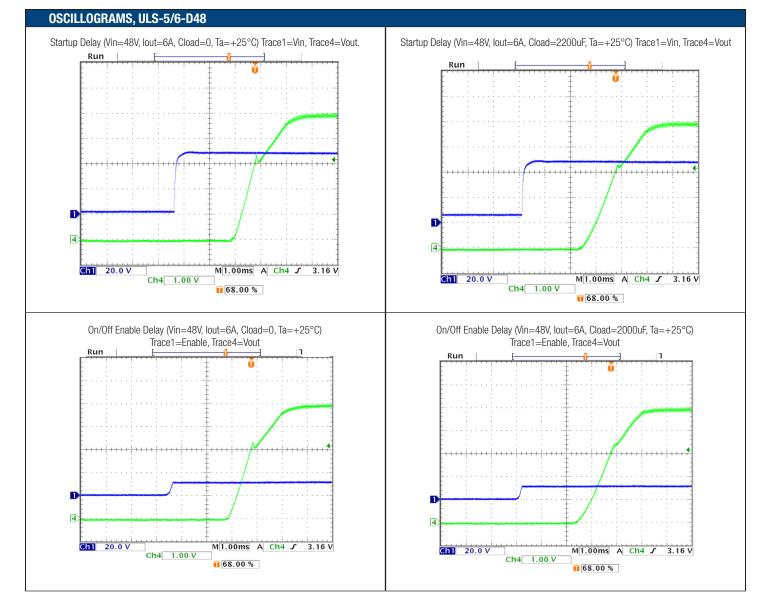


INFRARED THERMAL IMAGE, ULS-5/6-D48

Thermal image with hot spot at full current with 25°C ambient temperature. Natural convention is used with no forced airflow. Identifiable and recommended maximum value to be verified in application. Vin=48V, Q7 max temp=120°C/IPC9592 guidelines.



ULS 30-Watt Series



ULS 30-Watt Series



ULS 30-Watt Series

Sixteenth-brick DOSA-Compatible, Isolated DC/DC Converters

FUNCTIONAL SPECIFICATIONS, ULS-12/2.5-D48

Input Voltage, Translent 100 None 100 Work Solitation Voltage Input Reverse Polarity None, install external fase None Work Durput Reverse Polarity None, install external fase None Work Work Durput Reverse Polarity None, install external fase 0 15 Work Durput Control Power on, referred to -Vin 0 30 W Durput Contrant Current-limited, no famage, short-circuit protected 0 2.5 A Storage Temperature Range Wn – Zero frop proven -55 12.5 ~0 Storage Temperature Range Concritions to co -2.5 A -2.5 A Internoticular Specifications Table is not implied or recommended. Internoticular Specifications Table is not implied or recommended. -2.5 -2.5 -2.5 Vick Recommended External Fixes Fast biow 2 2.5 2.5 2.5 -2.5 Vick Developing shutdown Fast biow 2 2.5 -2.5 Vick Vick -2.5	ABSOLUTE MAXIMUM RATINGS	Conditions ①	Minimum	Typical/Nominal	Maximum	Units
Signition Voltage Insult or undrop, continuous Image 22800 VMc Dury IT Proves 0 Nome VMc VMc Dury IT Annote Control Prever on, referred to Ann 0 IS VMc Dury IT Annote Control Querest Limited, no damage, short circuit protected 0 IS VMc Storage Transportance Pranto under objective Transportance under control and objective transportance under control control doctectors transportance under control doctectors transportrandoctectors transportance under control doctectors tr	Input Voltage, Continuous		0			
Input Reverse Polarity None None None Work Divid If Remote Control Power on, referred to Vin 0 30 With Divid If Remote Control Current Internation on damage, short-circuit probled 0 30 With Strange Temperature Range Vin = Zoo (po power) -55 125 "C Strange Temperature Range Vin = Zoo (po power) -55 125 "C Strange Temperature Range Vin = Zoo (po power) -55 125 "C Strange Temperature Range Vin = Zoo (po power) -55 33.5 2.6.6 Vin = Too Vin Mark International Scale Classition India is not undiator continented. International Scale Classition India is not undiator continented. Vin = Too Vin Mark 2.6.6 Vin = Too Vin Mark Recommended Externational Scale Classition India Vin English India Vintagi 2.1.4 None Vin = Too Vin Mark Vin = Too Vin Mark </td <td>Input Voltage, Transient</td> <td></td> <td></td> <td></td> <td></td> <td></td>	Input Voltage, Transient					
DrivOlf Renove Control Peaker on, referred to -Vin 0 15 VMC Datput Current Current-limited, no damage, short-cicul protectiod 0 2.5 A Strage Temperature Range Vin = Zaro (top guzver) -55 125 °C Strage Temperature Range Vin = Zaro (top guzver) -55 125 °C Strage Temperature Range Vin = Zaro (top guzver) -55 125 °C Strade Temperature Range Vin = Zaro (top guzver) -55 125 °C Strade Temperature Range Current Temperature conditions may absensive absensind absensive absensive absensive absensind absensiv					2250	
Dubupt Power 0 30 W. Doubput Current Current-Initiation damage, short-dicuit protection 0 2.5 A Strange Temperature Range Vm = Zoo (no powor) 5.5 125 °C Would current Conditions (socializations Table is not ingited or commondual. INPUT Conditions (socializations Table is not ingited or commondual. VMC 2 A INPUT Conditions (socializations Table is not ingited or commondual. Socializations Table is not ingited or commondual. VMC 2 A Recommended External Fuse Fisit bow 2 3.6 4.9 2 A Undervicitige shutdown Falling input voltage 3.2 3.5 3.5 VVC		,		None		
Dutput Current Current-limited, in damage, short-circuit protected 0 2.5 A Storage Emperature Range Vin = Zero (np Drever) -55 125 "C Storage Emperature Range Vin = Zero (np Drever) -55 125 "C Storage Emperature Range Vin = Zero (np Drever) -55 125 "C Deparating used and entropy storage datasets by adversely affect long term reliability. Proper operation under conditions online may adversely affect long term reliability. Proper operation under conditions online term stora under conditions online conditions storage datasets at the storage dataset long term reliability. Proper operation under conditions online term stora under conditions storage dataset long term reliability. Proper operation under conditions storage dataset long term reliability. Proper operation under conditions storage dataset long term reliability. Proper operation under conditions storage dataset long term reliability. Proper operation under conditions storage dataset long term reliability. Proper operation under conditions dataset long term reliability. Proper operation under conditions storage dataset long term reliability. Proper operation under conditions storage dataset long term reliability. Proper operation under conditions storage dataset long term reliability. Proper operation under conditions dataset long term reliability. Proper operations at the storage dataset long term reliability. Proper operations at the storage dataset long term reliability. Proper operations at the storage dataset long term reliability. Proper operations at the storage dataset long term reliability. Proper operations at the st		Power on, referred to -Vin				
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United Conditions may deversely affect long-term reliability. Proper operation under conditions other than those listed in beardomanacid. UPU Deparating voltage range Conditions 000 Deparating voltage range Fast blow 36 48 75 V/O Recommended External Fuse Fast blow 32 33.5 35.5 V/O Breadmanned External Fuse Rains input voltage 31 32 33.5 36.5 V/O Breadmanned External Fuse Rains input voltage 31 32.6 33.5 V/O Breadmanned Hittery Deparation Non-e 14.0 14.46 1.5.2 V/O Breadmanned Hittery Deparation None, install external fuse Norre V/O V/O Reverse Polarity Protection None, install external fuse Norre V/O V/O Reverse Polarity Protection None, install external fuse Norre V/O V/O Reference Verse Norre V/N = minimum 0.05 A* So Polit Lood Conditions V/N = minimum 0.05 Not A <t< td=""><td>Output Current</td><td>Current-limited, no damage, short-circuit protected</td><td>0</td><td></td><td>2.5</td><td>А</td></t<>	Output Current	Current-limited, no damage, short-circuit protected	0		2.5	А
Performance/Eucliditions Table is not implied or recommended. Vinc Conditions (0:6) Operating voltage range Conditions (0:6) 2 A Start-up fineshold Rising input voltage 32.5 33.5 Vicc. Start-up fineshold Rising input voltage 32.5 33.5 Vicc. Provintinge stutiotion Rising input voltage 31 32 33.5 Vicc. Provintinge stutiotion Rising input voltage 11.40 1.46 1.52 Vicc. Provintinge stutiotion None None Vicc. Vicc. <t< td=""><td></td><td></td><td></td><td></td><td></td><td>-</td></t<>						-
INPUT Conditions 0:00 Becommender External Fuse Fast blow 2 A Bisne protivulage 31 2 33.5 VVic. Inder-orbage shutdown Falling input voltage 31 32 33 VVic. Inder-orbage shutdown Falling input voltage 31 32 33 VVic. Inder-orbage shutdown Falling input voltage 1.40 1.46 1.52 VVic. Inder-orbage shutdown None, install external fuse None VVic. VVic. Inder-orbage shutdown Win = nominal 0.71 0.73 A Instant Fransiter 0.055 0.37 A Instant frams frame 0.055 0.37 A Instant frams frame 0.055 0.37 A Instant frame Non-Bown input Current (Off, UV, OT) Measured at input with specified filter 15 30 mA, P.p Solution External Status Status Status Status Status Instal framat, Mail Bad <t< td=""><td></td><td></td><td>ersely affect long-term</td><td>reliability. Proper operation ur</td><td>nder conditions other the</td><td>an those listed i</td></t<>			ersely affect long-term	reliability. Proper operation ur	nder conditions other the	an those listed i
Operating voltage range						
Becommended External Fuse Fast blow		Conditions (1) (3)				
Start-up Intreshid Rising input voltage 32.5 33.5 35.5 V/cc. Indervoltage shutdown Falling input voltage 31 32 33 V/cc. Dervoltage shutdown 1.40 1.40 1.46 1.52 V/cc. Dervoltage shutdown None, install external fuse None V/cc. V/cc. Dervoltage shutdown None, install external fuse None V/cc. V/cc. Dervoltage shutdown 0.01 0.71 0.73 A Dervoltage shutdown 0.95 0.97 A Dival Conditions Vin = nominal 0.05 0.74 A Low Line 0.05 0.73 A		5	36	48		-
Inder-orlage shutdown Falling input voltage 31 32 33 Voic Unrue-norlage shutdown 1.40 1.46 1.52 Voic Derivelage shutdown None, install external fuse None Voic Voic Reverse Polarity Protection None, install external fuse None Voic Voic appt current Capacitive Capacitive Capacitive Voic Capacitive Voic Insush Transient 0.05 0.77 A Low Line Voin = minimum, unit = 0N 25 50 nm Shut-Down Input Current (Off, UV, OT) Measured at input with specified filter 15 30 mA, p-p CEVERAL and SAFETY Vin = minimum, unit = 0N 255 67.5 % Bolation Vin = minimum, unit = 0N 255 67.5 % Solation 15 30 mA, p-p Capacitive % Insush Transient 0.01 minimum, unit = 0N 255 67.5 % Solation Solation				00.5		-
Jum-On/Tum-Off Hystersis I.40 I.40 I.40 I.40 I.40 I.40 I.40 Wdc Reverse Polarity Protection None, install external fuse None Wdc Wdc Reverse Polarity Protection None, install external fuse None Wdc Wdc Dept Current Capacitive Capacitive Capacitive Wdc Full Load Conditions Un = nominal 0.71 0.73 A Low Line Win = minimum 0.05 0.97 A Low Line Win = minimum, unit = 0N 0.05 0.73 A Stut-Down Input Current (Orf, W OT) Measured at Input with specified filter 15 30 mA, p. p. Efficiency Vin = min, full load 86.0 87.7 % Solation Solation Min = May Min I load 85.5 87.5 % Isolation Resistance Input to output, continuous 2250 Basic % Isolation Resistance Input Super Super I, Gass G, Guord I Yes % Isolation Resis						
Decretage shutdown None, install external fixe None Vdc. Reverse Polarity Protection None, install external fixe None Vdc. maper Severse Polarity Protection None, install external fixe Capacitive Vdc. maper Severse Polarity Protection 0.71 0.73 A Low Line Win = nominal 0.071 0.73 A Low Line Win = minimum 0.95 0.97 A Insush Transient 0.05 mA A A No Load Iout = minimum, unit = 0N 25 50 mA No Load Iout = minimum, unit = 0N 25 10 mA Shut-Down Input Current (2) Measured at input with specified filter 15 30 mA effetedet (acak) Win = 489, full load 85.5 87.5 % Station Efficiency Vin = 489, full load 85.5 87.5 % Insulation Statege Rating Input to oxtput, continuous 2250 Vdc More states Isolation Capacithace		Falling input voltage	-	-		
Reverse Folarity Protection None, install external fuse None Vdc Internal Filter Type Capacitive Capacitive Image: Capacitive			1.40	-	1.52	
Internal Filter Type Capacitive Capacitive Input current 0.71 0.73 A Low Line 0.95 0.97 A Low Line 0.05 0.73 A Data Shut-Down Input Current (07, UV, 07) 0.01 100 200 mA Shut-Down Input Current (07, UV, 07) Measured at input with specified filter 5 10 mA GEHERAL and SAFETY Vin = min, full load 86.0 87.7 % Station Vin = min, full load 85.5 87.5 % Isolation Safety Rating Isolation Capacitive Vin = min, full load 86.0 87.7 % Isolation Gapacitance Input to output, continuous 2250 Ma Ma Isolation Gapacitance Isolation Gapacitance 1000 Ma Ma <						
put current Vin = nominal 0.71 0.73 A Full Load Conditions Vin = nominal 0.71 0.73 A Low Line Vin = minimum 0.95 0.97 A Low Line Vin = minimum 0.05	· · · · · · · · · · · · · · · · · · ·	None, install external fuse				Vdc
Full Lad Conditions Wn = noninal 0.71 0.73 A Low Line Vin = minimum 0.95 0.97 A Inrush Trasient 0.05 0.75 A Inrush Trasient 0.05 0.75 A Nu Lad tout = minimum, unit = 0N 25 50 mA Shut-Down Input Current (Off, UV, OT) Measured at input with specified filter 15 30 mA, P Effected flack/i ripple current © Measured at input with specified filter 15 30 mA, P Effected flack/i ripple current © Measured at input with specified filter 15 30 mA, P Effected flack/i ripple current © Win = 48V, full load 86.0 87.7 % Insulation Safety Rating Insulation Safety Rating E250 Vdc % Isolation Oragacitance Input to output, continuous 2250 Vdc MO Isolation Rapacitance 100 MO MO MO MO Isolation Safety Rating Per Telecordia SR332, issus 1, class 3, ground fixed, Tambient = +25°C				Capacitive		
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Or Youtof Youtof YoutDynamic Load Peak Deviationsame as above±250±300mVFEATURES and OPTIONSRemote On/Off Control ©"N" suffix:Negative Logic, ON stateON = Ground pin or external voltage-0.10.8VNegative Logic, OFF stateOFF = Pin open or external voltage2.515VControl CurrentOpen collector/drain12mA"P" suffix:Positive Logic, OFF stateOFF = Fin open or external voltage1015VPositive Logic, OFF stateOFF = Ground pin or external voltage1015VPositive Logic, OFF stateOFF = Ground pin or external voltage00.7VPositive Logic, OFF stateOFF = Ground pin or external voltage00.7VOpen collector/drain12mA	Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency Startup Time	Vin = min., full load Input to output, continuous Certified to 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	2250	basic 100 1600 Yes 3	30	Vdc MΩ pF Hours x 10 KHz mS
FEATURES and OPTIONS Remote On/Off Control © "N" suffix: ON = Ground pin or external voltage -0.1 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: ON = Pin open or external voltage 10 15 V 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 Positive Logic, OFF state OFF = Ground pin or external voltage 0 0.7 V Positive Logic, OFF state OFF = Ground pin or external voltage 0 1 2 mA	solation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency Startup Time Startup Time	Vin = min., full load Input to output, continuous Input to output, continuous Certified to 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%	2250	basic 100 1600 Yes 3 285	30 30	Vdc MΩ pF Hours x 10 KHz mS mS
Remote On/Off Control © "N" suffix: Negative Logic, ON state ON = Ground pin 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 ON = Pin open or external voltage 10 15 V Positive Logic, OFF state OFF = Ground pin or external voltage 0 0.7 V Positive Logic, OFF state OFF = Ground pin or external voltage 0 1 2 mA	Isolation Isolation Voltage Insulation Safety Rating Isolation Capacitance Safety Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency Startup Time Startup Time Dynamic Load Response	Vin = min., full load Input to output, continuous Input to output, continuous Certified to 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	2250	basic 100 1600 Yes 3 285 200	30 30 300	Vdc MΩ pF Hours x 10 KHz mS mS μSec
"N" suffix: Negative Logic, ON state ON = Ground pin 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 ON = Pin open or external voltage 10 15 V Positive Logic, OFF state OFF = Ground pin or external voltage 0 0.7 V Control Current Open collector/drain 1 2 mA	solation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency Startup Time Startup Time Dynamic Load Response Dynamic Load Peak Deviation	Vin = min., full load Input to output, continuous Input to output, continuous Certified to 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	2250	basic 100 1600 Yes 3 285 200	30 30 300	Vdc MΩ pF Hours x 10' KHz mS mS μSec
Negative Logic, ON state ON = Ground pin 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, OFF state ON = Pin open or external voltage 10 15 V Positive Logic, OFF state ON = Pin open or external voltage 00 0.7 V Positive Logic, OFF state OFF = Ground pin or external voltage 0 0.7 V Positive Logic, OFF state Open collector/drain 1 2 mA	solation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency Startup Time Startup Time Dynamic Load Response Dynamic Load Peak Deviation FEATURES and OPTIONS	Vin = min., full load Input to output, continuous Input to output, continuous Certified to 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	2250	basic 100 1600 Yes 3 285 200	30 30 300	Vdc MΩ pF Hours x 10' 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: 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 Control Current Open collector/drain 1 2 mA	solation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety 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 ③	Vin = min., full load Input to output, continuous Input to output, continuous Certified to 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	2250	basic 100 1600 Yes 3 285 200	30 30 300	Vdc MΩ pF Hours x 10 KHz mS mS μSec
Control Current Open collector/drain 1 2 mA "P" suffix:	solation Isolation Voltage Insulation Safety Rating Isolation Capacitance Safety Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency Startup Time Startup Time Oynamic Load Response Dynamic Load Peak Deviation FEATURES and OPTIONS Remote On/Off Control (S) "N" suffix:	Vin = min., full load Input to output, continuous Input to output, continuous Certified to 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	2250	basic 100 1600 Yes 3 285 200	30 30 300 ±300	Vdc MΩ pF Hours x 10 KHz mS mS μSec 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 Control Current Open collector/drain 1 2 mA	solation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety 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: Negative Logic, ON state	Vin = min., full load Input to output, continuous Input to output, continuous Certified to 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 = Ground pin or external voltage	2250	basic 100 1600 Yes 3 285 200	30 30 300 ±300	Vdc MΩ pF Hours x 10 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 Control Current Open collector/drain 1 2 mA	Isolation Isolation Voltage Insulation Safety Rating Isolation Capacitance Isolation Capacitance Safety 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: Negative Logic, ON state Negative Logic, OFF state	Vin = min., full load Input to output, continuous Input to output, continuous Certified to 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 = Ground pin or external voltage OFF = Pin open or external voltage	2250	basic 100 1600 Yes 3 285 200	30 30 300 ±300 0.8 15	Vdc MΩ pF Hours x 10 KHz mS mS μSec mV
Positive Logic, OFF state OFF = Ground pin or external voltage 0 0.7 V Control Current Open collector/drain 1 2 mA	Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety 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: Negative Logic, ON state Negative Logic, OFF state Control Current	Vin = min., full load Input to output, continuous Input to output, continuous Certified to 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 = Ground pin or external voltage OFF = Pin open or external voltage	2250	basic 100 1600 Yes 3 285 200 ±250	30 30 300 ±300 0.8 15	Vdc MΩ pF Hours x 10 KHz mS mS μSec mV
Control Current Open collector/drain 1 2 mA	Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety 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: Negative Logic, OFF state Control Current "P" suffix:	Vin = min., full load Input to output, continuous Input to output, continuous Certified to 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 = Ground pin or external voltage OFF = Pin open or external voltage Open collector/drain	2250	basic 100 1600 Yes 3 285 200 ±250	30 30 300 ±300 0.8 15	Vdc MΩ pF Hours x 10 KHz mS mS μSec mV
	solation Isolation Voltage Insulation Safety Rating Isolation Capacitance Safety Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency Startup Time Startup Time Oynamic Load Response Dynamic Load Peak Deviation FEATURES and OPTIONS Remote On/Off Control © "N" suffix: Negative Logic, OFF state Control Current "P" suffix:	Vin = min., full load Input to output, continuous Input to output, continuous Certified to 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 = Ground pin or external voltage OFF = Pin open or external voltage Open collector/drain	2250 260 -0.1 2.5	basic 100 1600 Yes 3 285 200 ±250	30 30 300 ±300 0.8 15 2	Vdc MΩ pF Hours x 10 KHz mS mS μSec mV V V V
SMT Mounting "M" suffix	Isolation Isolation Voltage Insulation Safety Rating Isolation Capacitance Isolation Capacitance Safety 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: Negative Logic, OFF state Control Current "P" suffix: Positive Logic, ON state Negative Logic, ON state	Vin = min., full load Input to output, continuous Input to output, continuous Certified to 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 = Ground pin or external voltage OFF = Pin open or external voltage ON = Pin open or external voltage OFF = Ground pin or external voltage	2250 260 -0.1 2.5 10	basic 100 1600 Yes 3 285 200 ±250	30 30 300 ±300 0.8 15 2 15	Vdc MΩ pF Hours x 10 KHz mS mS μSec mV V V V V
	Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety 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: Negative Logic, ON state Positive Logic, OFF state Control Current "P" suffix: Positive Logic, OFF state Control Current	Vin = min., full load Input to output, continuous Input to output, continuous Certified to 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 = Ground pin or external voltage OFF = Pin open or external voltage OP = OPIN open or external voltage ON = Pin open or external voltage OFF = Ground pin or external voltage OFF = Ground pin or external voltage OFF = Ground pin or external voltage OP = Pin open or external voltage OFF = Ground pin or external voltage	2250 260 -0.1 2.5 10	basic 100 1600 Yes 3 285 200 ±250 1	30 30 300 ±300 0.8 15 2 15 0.7	Vdc MΩ pF Hours x 10 ⁶ KHz mS mS μSec mV V V V V V

ULS 30-Watt Series

Sixteenth-brick DOSA-Compatible, Isolated DC/DC Converters

FUNCTIONAL SPECIFICATIONS, ULS-12/2.5-D48 (CONT.)

OUTPUT	Conditions ①	Minimum	Typical/Nominal	Maximum	Units
Total Output Power	See Derating	0	30	30	W
Voltage	· · · · · ·				
Nominal Output Voltage	No trim	11.88	12.00	12.12	Vdc
Setting Accuracy	At 50% load, no trim	-1		+1	% of Vnom
Output Voltage Range	User-adjustable	-20		+10	% of Vnom.
Overvoltage Protection	Via magnetic feedback	13.3	15	18	Vdc
Current	· · · · ·				
Output Current Range		0.0	2.5	2.5	A
Minimum Load			No minimum load		
Current Limit Inception	98% of Vnom., after warmup	3.3	3.5	4.5	A
Short Circuit	· · · ·				
Short Circuit Current	Hiccup technique, autorecovery within ±1.25% of Vout			40	mA
Short Circuit Duration (remove short for recovery)	Output shorted to ground, no damage		Continuous		
Short circuit protection method	Current limiting				
Regulation ©			1		
Line Regulation	Vin = min. to max., Vout = nom., lout = nom.			±0.125	% of Vout
Load Regulation	lout = min. to max., Vin = 48V			±0.125	% of Vout
Ripple and Noise	5 Hz- 20 MHz BW		130	150	mV pk-pk
Temperature Coefficient	At all outputs		±0.02		% of Vout./°C
Maximum Capacitive Loading	Low ESR, resistive load only	0	2200		μF
MECHANICAL (Through Hole Models)	Conditions				
Outline Dimensions			1.30x0.90x0.36		Inches
(Please refer to outline drawing)	LxWxH		33.02x22.86x9.144		mm
Weight			0.58		Ounces
			16.4		Grams
Through Hole Pin Diameter			0.04 & 0.062		Inches
			1.016 & 1.575		mm
Through Hole Pin Material			Copper alloy		
TH Pin Plating Metal and Thickness	Nickel subplate		50		µ-inches
	Gold overplate		5		µ-inches
ENVIRONMENTAL					
Operating Ambient Temperature Range	With Derating	-40		85	°C
Operating Case Temperature Range	No derating, full power	-40		105	°C
Storage Temperature	Vin = Zero (no power)	-55		125	°C
Thermal Protection/Shutdown	Measured in center	115	125	130	°C
Electromagnetic Interference	External filter is required				
Conducted, EN55022/CISPR22			В		Class
Radiated, EN55022/CISPR22			В		Class
Relative humidity, non-condensing	To +85°C	10		90	%RH
Altitude	must derate -1%/1000 feet	-500		10,000	feet
		-152		3048	meters
RoHS rating ④			RoHS-6		

Performance Specification Notes

Unless otherwise noted, all specifications are typical at nominal input voltage, nominal output voltage and full load. General conditions are +25° Celsius ambient temperature, near sea level altitude, natural convection airflow. All models are tested and specified with external parallel 1 μ F and 10 μ F multi-layer ceramic output capacitors. The external input capacitor is 22 μ F ceramic. 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.

Input (back) ripple current is tested and specified over 5 Hz to 20 MHz bandwidth. Input filtering is Cbus = $220 \ \mu\text{F}/100\text{V}$, Cin = $33 \ \mu\text{F}/100\text{V}$ and Lbus = $12 \ \mu\text{H}$.

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

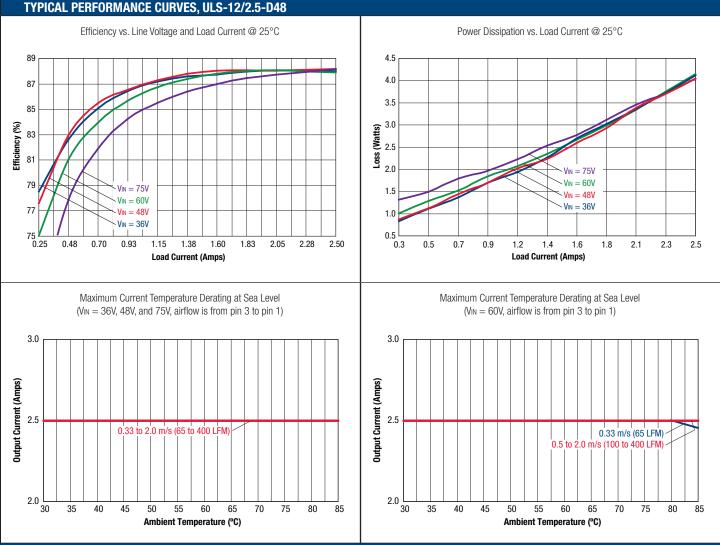
Reduction of Hazardous Substances (RoHS) compliance is to RoHS-6 (six substances restricted including lead). See specifications.

The Remote On/Off Control is referred to -Vin.

Regulation specifications describe the output voltage changes as the line voltage or load current is varied from its nominal or midpoint value to either extreme.

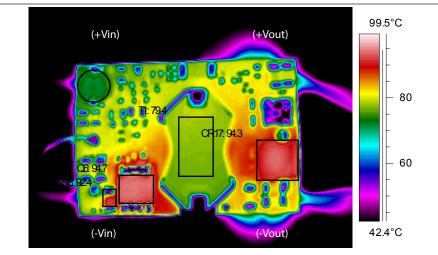
ULS 30-Watt Series

Sixteenth-brick DOSA-Compatible, Isolated DC/DC Converters



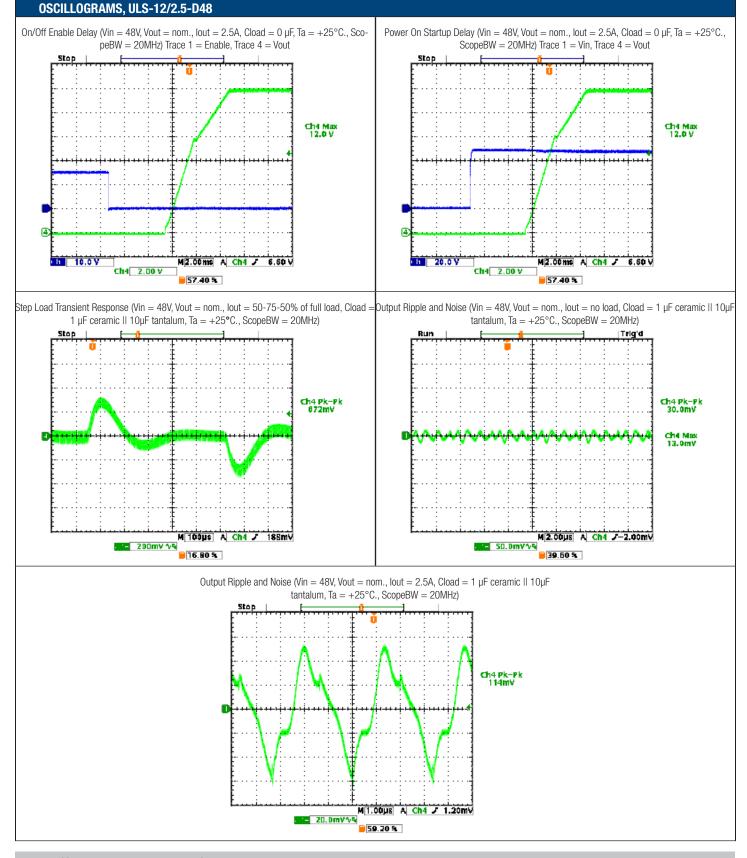
INFRARED THERMAL IMAGE, ULS-12/2.5-D48

Thermal image with hot spot at full load current with 25 °C ambient temperature. Natural convention is used with no forced airflow. Identifiable and recommended maximum value to be verified in application. Vin=48V, Q6 max Temp=120 °C/IPC9592 guidelines.



ULS 30-Watt Series

Sixteenth-brick DOSA-Compatible, Isolated DC/DC Converters



https://www.murata-ps.com/support

ULS 30-Watt Series

Sixteenth-brick DOSA-Compatible, Isolated DC/DC Converters

FUNCTIONAL SPECIFICATIONS, ULS-15/2-D48

ABSOLUTE MAXIMUM RATINGS	Conditions ①	Minimum	Typical/Nominal	Maximum	Units
Input Voltage, Continuous		0	rypical/Nominal	80	Vdc
Input Voltage, Transient	100 mS max. duration	0		100	Vdc
Isolation Voltage	Input to output, continuous			2250	Vdc
Input Reverse Polarity	None, install external fuse		None	LLOO	Vdc
On/Off Remote Control	Power on, referred to -Vin	0	None	15	Vdc
Output Power		0		30	W
Output Current	Current-limited, no damage, short-circuit protected	0		2	A
Storage Temperature Range	Vin = Zero (no power)	-55		125	°C
	f devices to greater than any of these conditions may a		reliability Proper operation		-
the Performance/Functional Specifications Table is	not implied or recommended	auversely affect forty-term	r reliability. I roper operation		an those histed in
INPUT	Conditions ①③				
Operating voltage range		36	48	75	Vdc
Recommended External Fuse	Fast blow		10	2	A
Start-up threshold	Rising input voltage	32.5	33.5	35.5	Vdc
Undervoltage shutdown	Falling input voltage	31	32	33	Vdc
Turn-On/Turn-Off Hysteresis		1.42	1.48	1.52	Vdc
Overvoltage shutdown		1.12	None	1.02	Vdc
Reverse Polarity Protection	None, install external fuse		None		Vdc
Internal Filter Type			Capacitive		100
Input current			Oupdolitivo		
Full Load Conditions	Vin = nominal		0.7	0.714	A
Low Line	Vin = minimum		0.94	0.95	A
Inrush Transient			0.05	0.00	A ² -Sec.
Output in Short Circuit			100	200	mA
No Load	lout = minimum, unit = ON		25	50	mA
Shut-Down Input Current (Off, UV, OT)			5	10	mA
Reflected (back) ripple current @	Measured at input with specified filter		15	30	mA, p-p
GENERAL and SAFETY	modourou de input with opcomed mitor		10	00	nn, pp
	Vin – 48V full load	87 5	89.0		%
Efficiency	Vin = 48V, full load Vin = min_full load	87.5 87.5	89.0 89.0		%
Efficiency	Vin = 48V, full load Vin = min., full load	87.5 87.5	89.0 89.0		%
Efficiency Isolation	Vin = min., full load	87.5			
Efficiency Isolation Isolation Voltage			89.0		%
Efficiency Isolation Isolation Voltage Insulation Safety Rating	Vin = min., full load	87.5	89.0		Vdc
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance	Vin = min., full load	87.5	89.0 basic 100		% Vdc ΜΩ
Efficiency Isolation Isolation Voltage Insulation Safety Rating	Vin = min., full load Input to output, continuous Certified to UL-60950-1, CSA-C22.2 No.60950-1,	87.5	89.0		Vdc
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance	Vin = min., full load Input to output, continuous Certified to UL-60950-1, CSA-C22.2 No.60950-1, IEC/EN60950-1, 2nd edition	87.5	89.0 basic 100 1600		% Vdc ΜΩ
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance	Vin = min., full load Input to output, continuous Certified to UL-60950-1, CSA-C22.2 No.60950-1,	87.5	89.0 basic 100 1600		% Vdc ΜΩ
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety	Vin = min., full load Input to output, continuous Certified to UL-60950-1, CSA-C22.2 No.60950-1, IEC/EN60950-1, 2nd edition Per Telcordia SR332, issue 1, class 3, ground	87.5	89.0 basic 100 1600 Yes		% Vdc MΩ pF
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety Calculated MTBF	Vin = min., full load Input to output, continuous Certified to UL-60950-1, CSA-C22.2 No.60950-1, IEC/EN60950-1, 2nd edition Per Telcordia SR332, issue 1, class 3, ground	87.5	89.0 basic 100 1600 Yes	310	% Vdc MΩ pF
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety Calculated MTBF DYNAMIC CHARACTERISTICS	Vin = min., full load Input to output, continuous Certified to UL-60950-1, CSA-C22.2 No.60950-1, IEC/EN60950-1, 2nd edition Per Telcordia SR332, issue 1, class 3, ground	87.5	89.0 basic 100 1600 Yes 3	<u>310</u> 30	% Vdc MΩ pF Hours x 10 ⁶
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency	Vin = min., full load Input to output, continuous Certified to 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	87.5	89.0 basic 100 1600 Yes 3		% Vdc PF Hours x 10 ⁶ KHz
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency Startup Time	Vin = min., full load Input to output, continuous Certified to 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%	87.5	89.0 basic 100 1600 Yes 3	30	% Vdc pF Hours x 10 ⁶ KHz mS
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency Startup Time Startup Time Dynamic Load Response	Vin = min., full load Input to output, continuous Certified to 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	87.5	89.0 basic 100 1600 Yes 3 290 200	30 30 300	% Vdc pF Hours x 10 ⁶ KHz mS mS μSec
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency Startup Time Startup Time Dynamic Load Response Dynamic Load Peak Deviation	Vin = min., full load Input to output, continuous Certified to 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%	87.5	89.0 basic 100 1600 Yes 3 290	30 30	% Vdc pF Hours x 10 ⁶ KHz mS mS
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety Calculated MTBF DYNAMIC CHARACTERISTICS Fixed Switching Frequency Startup Time Startup Time Dynamic Load Response Dynamic Load Peak Deviation FEATURES and OPTIONS	Vin = min., full load Input to output, continuous Certified to 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	87.5	89.0 basic 100 1600 Yes 3 290 200	30 30 300	% Vdc pF Hours x 10 ⁶ KHz mS mS μSec
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety 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 ©	Vin = min., full load Input to output, continuous Certified to 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	87.5	89.0 basic 100 1600 Yes 3 290 200	30 30 300	% Vdc pF Hours x 10 ⁶ KHz mS mS μSec
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety 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 = min., full load Input to output, continuous Certified to 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 same as above	87.5 2250 280	89.0 basic 100 1600 Yes 3 290 200	30 30 300 ±300	% Vdc pF Hours x 10 ⁶ KHz mS mS μSec mV
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety 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: Negative Logic, ON state	Vin = min., full load Input to output, continuous Certified to 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 same as above ON = Ground pin or external voltage	87.5 2250 280 -0.1	89.0 basic 100 1600 Yes 3 290 200	30 30 300 ±300	% Vdc pF Hours x 10 ⁶ KHz mS mS μSec mV
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety 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: Negative Logic, ON state Negative Logic, OFF state	Vin = min., full load Input to output, continuous Certified to 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 = Ground pin or external voltage OFF = Pin open or external voltage	87.5 2250 280	89.0 basic 100 1600 Yes 3 290 200 ±250	30 30 300 ±300 0.8 15	% Vdc pF Hours x 10 ⁶ KHz mS mS μSec mV
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety 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, ON state Negative Logic, OFF state Control Current	Vin = min., full load Input to output, continuous Certified to 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 same as above ON = Ground pin or external voltage	87.5 2250 280 -0.1	89.0 basic 100 1600 Yes 3 290 200	30 30 300 ±300	% Vdc pF Hours x 10 ⁶ KHz mS mS μSec mV
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety 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 = min., full load Input to output, continuous Certified to 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 = Ground pin or external voltage OFF = Pin open or external voltage Open collector/drain	87.5 2250 280 -0.1 2.5	89.0 basic 100 1600 Yes 3 290 200 ±250	30 30 300 ±300 0.8 15 2	% Vdc pF Hours x 10 ⁶ KHz mS mS μSec mV V V V
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety 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 = min., full load Input to output, continuous Input to output, continuous Certified to 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 = Ground pin or external voltage OFF = Pin open or external voltage OPen collector/drain ON = Pin open or external voltage	87.5 2250 280 -0.1 2.5 10	89.0 basic 100 1600 Yes 3 290 200 ±250	30 30 300 ±300 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
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety 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, OF state Control Current "P" suffix: Positive Logic, OFF state Positive Logic, OFF state Positive Logic, OFF state	Vin = min., full load Input to output, continuous Input to output, continuous Certified to 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 = Ground pin or external voltage OFF = Pin open or external voltage OPen collector/drain ON = Pin open or external voltage OFF = Ground pin or external voltage	87.5 2250 280 -0.1 2.5	89.0 basic 100 1600 Yes 3 290 ±250 ±250	30 30 300 ±300 0.8 15 2 15 2 15 0.7	% Vdc MΩ pF Hours x 10 ⁶ KHz mS μSec mV V
Efficiency Isolation Isolation Voltage Insulation Safety Rating Isolation Resistance Isolation Capacitance Safety 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 = min., full load Input to output, continuous Input to output, continuous Certified to 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 = Ground pin or external voltage OFF = Pin open or external voltage OPen collector/drain ON = Pin open or external voltage	87.5 2250 280 -0.1 2.5 10	89.0 basic 100 1600 Yes 3 290 200 ±250	30 30 300 ±300 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

ULS 30-Watt Series

Sixteenth-brick DOSA-Compatible, Isolated DC/DC Converters

FUNCTIONAL SPECIFICATIONS, ULS-15/2-D48 (CONT.)

OUTPUT	Conditions ①	Minimum	Typical/Nominal	Maximum	Units
Total Output Power	See Derating	0	30	30	W
Voltage	· · · · · · · · ·				
Nominal Output Voltage	No trim	14.85	15.00	15.15	Vdc
Setting Accuracy	At 50% load, no trim	-1		+1	% of Vnom
Output Voltage Range	User-adjustable	-20		+10	% of Vnom.
Overvoltage Protection	Via magnetic feedback	18	19	20	Vdc
Current					
Output Current Range		0.0	2.0	2.0	A
Minimum Load			No minimum load		
Current Limit Inception	98% of Vnom., after warmup	2.45	3.0	3.45	A
Short Circuit			1 1		
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 ©	· · · ·				
Line Regulation	Vin = min. to max., Vout = nom., lout = nom.			±0.125	% of Vout
Load Regulation	lout = min. to max., Vin = 48V			±0.125	% of Vout
Ripple and Noise	5 Hz- 20 MHz BW		115	125	mV pk-pk
Temperature Coefficient	At all outputs		±0.02		% of Vout./°C
Maximum Capacitive Loading	Low ESR, resistive load only	0	2200		μF
MECHANICAL (Through Hole Models)	Conditions ① ③				
Outline Dimensions			1.30x0.90x0.36		Inches
(Please refer to outline drawing)	LxWxH		33.02x22.86x9.144		mm
Weight			0.58		Ounces
			16.4		Grams
Through Hole Pin Diameter			0.04 & 0.062		Inches
			1.016 & 1.575		mm
Through Hole Pin Material			Copper alloy		
TH Pin Plating Metal and Thickness	Nickel subplate		50		µ-inches
	Gold overplate		5		µ-inches
ENVIRONMENTAL					
Operating Ambient Temperature Range	With Derating	-40		85	°C
Operating Case Temperature Range	No derating, full power	-40		105	°C
Storage Temperature	Vin = Zero (no power)	-55		125	°C
Thermal Protection/Shutdown	Measured in center	115	125	130	°C
Electromagnetic Interference	External filter is required	-			
Conducted, EN55022/CISPR22			В		Class
Radiated, EN55022/CISPR22			B		Class
Relative humidity, non-condensing	To +85°C	10		90	%RH
Altitude	must derate -1%/1000 feet	-500		10,000	feet
		-152		3048	meters
RoHS rating ④		-	RoHS-6		

Performance Specification Notes

Unless otherwise noted, all specifications are typical at nominal input voltage, nominal output voltage and full load. General conditions are $+25^{\circ}$ Celsius ambient temperature, near sea level altitude, natural convection airflow. All models are tested and specified with external parallel 1 μ F and 10 μ F multi-layer ceramic output capacitors. The external input capacitor is 22 μ F ceramic. 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.

Input (back) ripple current is tested and specified over 5 Hz to 20 MHz bandwidth. Input filtering is Cbus = $220 \ \mu\text{F}/100\text{V}$, Cin = $33 \ \mu\text{F}/100\text{V}$ and Lbus = $12 \ \mu\text{H}$.

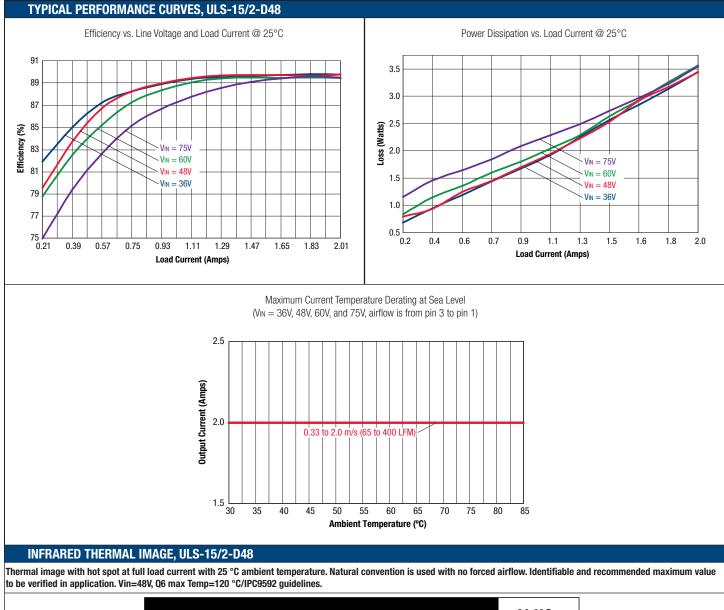
All models are stable and regulate to specification under no load.

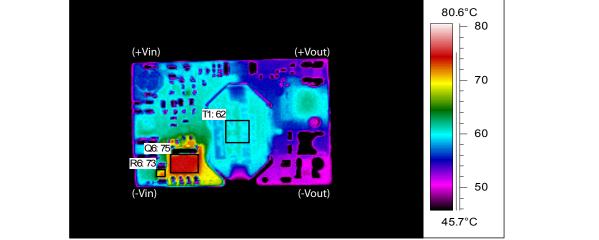
Reduction of Hazardous Substances (RoHS) compliance is to RoHS-6 (six substances restricted including lead). See specifications.

The Remote On/Off Control is referred to -Vin.

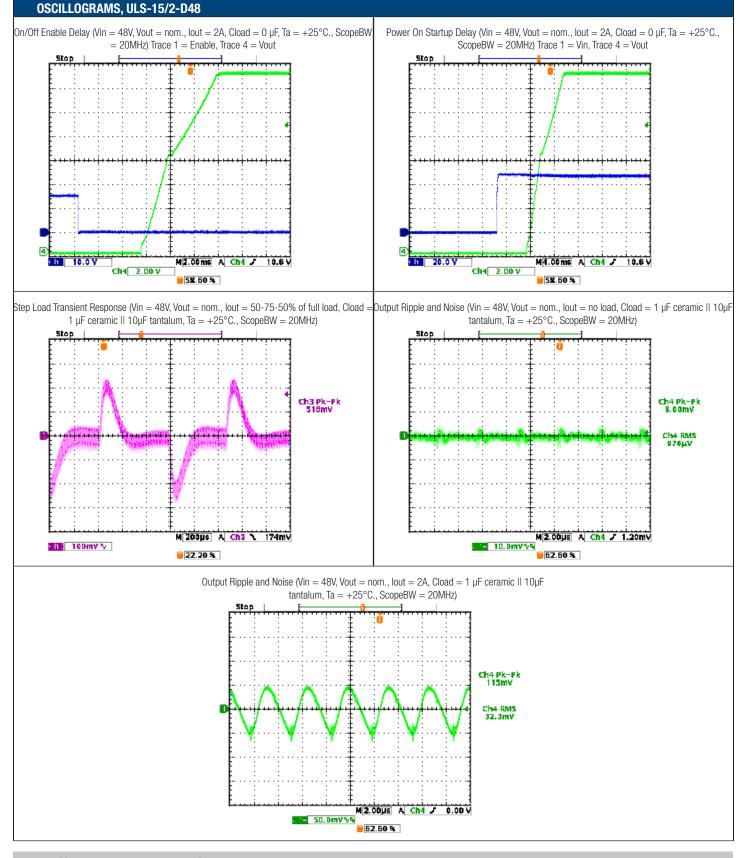
Regulation specifications describe the output voltage changes as the line voltage or load current is varied from its nominal or midpoint value to either extreme.

ULS 30-Watt Series

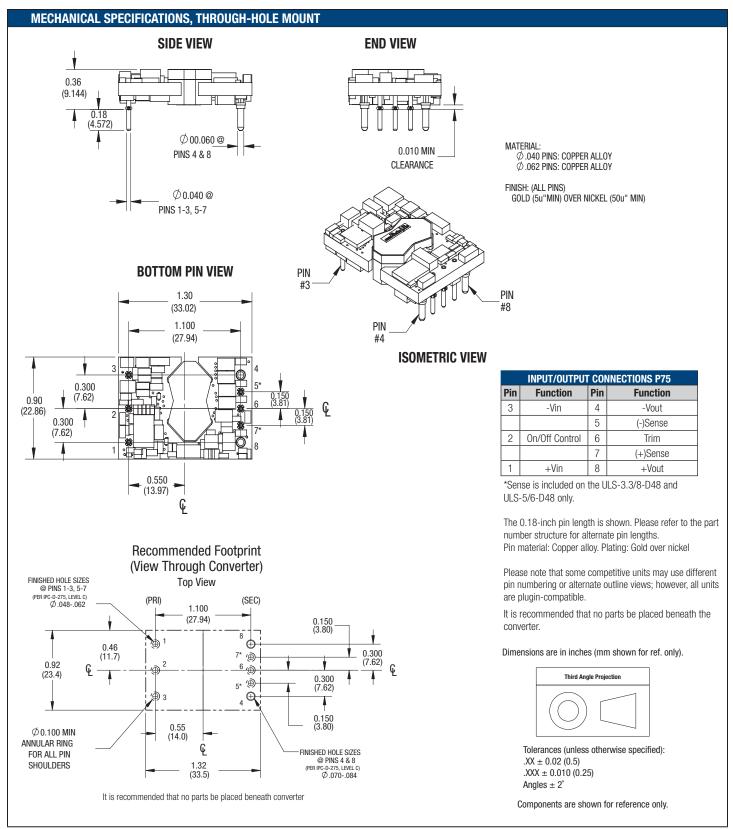




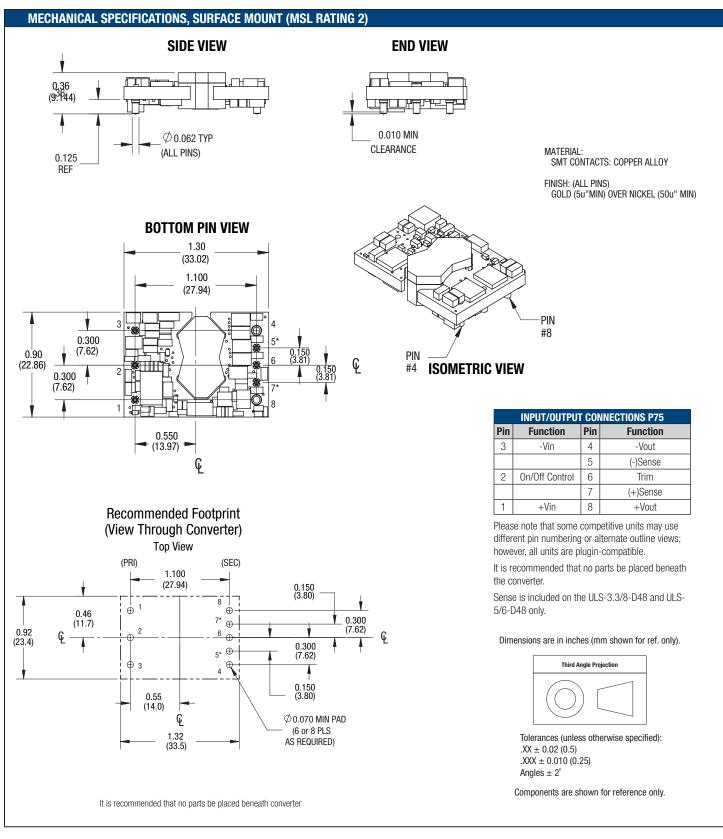
ULS 30-Watt Series



ULS 30-Watt Series



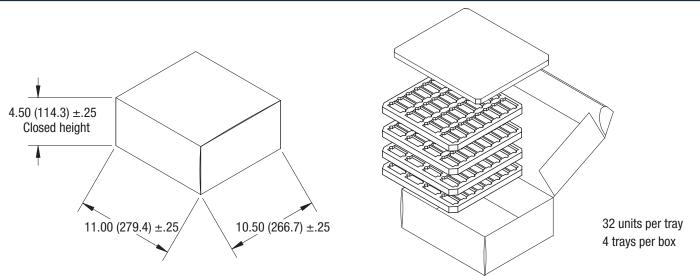
ULS 30-Watt Series





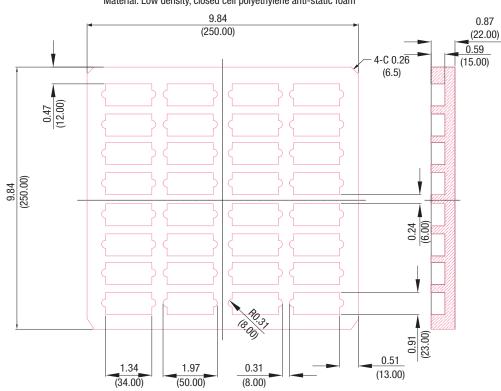
Sixteenth-brick DOSA-Compatible, Isolated DC/DC Converters





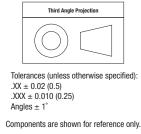
Each static dissipative polyethylene foam tray accommodates 32 converters in a 4 x 8 array.

SHIPPING TRAY DIMENSIONS



Material: Low density, closed cell polyethylene anti-static foam

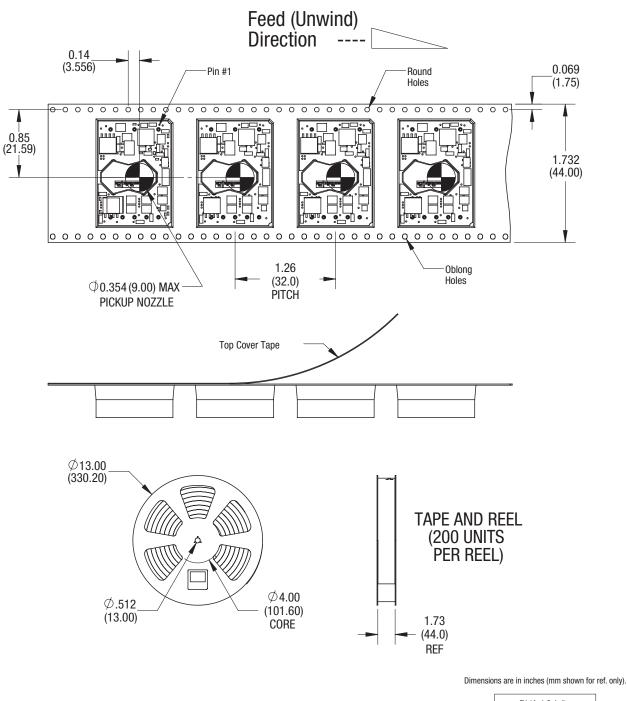
Dimensions are in inches (mm shown for ref. only).

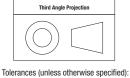




Sixteenth-brick DOSA-Compatible, Isolated DC/DC Converters

TAPE AND REEL INFORMATION (MSL RATING 2)





.XX \pm 0.02 (0.5) .XXX \pm 0.010 (0.25) Angles \pm 1°

Components are shown for reference only.



Sixteenth-brick DOSA-Compatible, 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 DATEL ULS 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 ULS 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 VIN 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 VIN to VOUT and from On/Off Control to VOUT is therefore insignificant.

Input Source Impedance

The input of ULS 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 ULS 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, C_{BUS} and L_{BUS} simulate a typical dc voltage bus. Your specific system configuration may necessitate additional considerations.

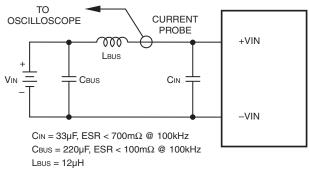


Figure 2. Measuring Input Ripple Current

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.

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

ULS 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.

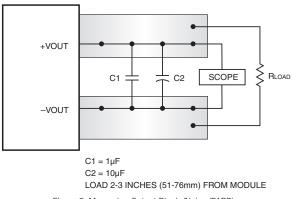


Figure 3. Measuring Output Ripple/Noise (PARD)

Thermal Shutdown

The ULS 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 ULS 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.

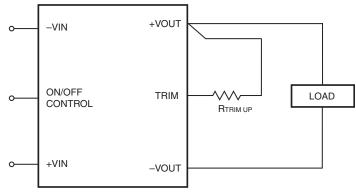


Figure 5. Trim Connections To Increase Output Voltages. If units have sense pins, Connect trim to + Sense pin.

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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 ULS Series is capable of enduring an indefinite short circuit output condition.

ULS 30-Watt Series

Sixteenth-brick DOSA-Compatible,

Isolated DC/DC Converters

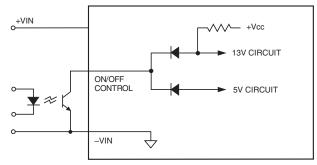
On/Off Control

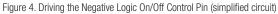
The input-side, remote On/Off Control function can be ordered to operate with either logic type:

Positive ("P" suffix) logic models are enabled when the on/off pin is left open (or is pulled high, applying +10V to +15V with respect to –Input). Positive-logic devices are disabled when the on/off pin is pulled low (0 to 0.7V with respect to –Input).

Negative ("N" suffix) logic devices are off when pin is left open (or pulled high, applying +2.5V to +15V), and on when pin is pulled low (-0.1 to 0.8V) with respect to -Input as shown in Figure 4.

Dynamic control of the remote on/off function is best accomplished with a mechanical relay or an open-collector/open-drain drive circuit (optically isolated if appropriate). The drive circuit should be able to sink appropriate current (see Performance Specifications) when activated and withstand appropriate voltage when deactivated. Applying an external voltage to pin 2 when no input power is applied to the converter can cause permanent damage to the converter.





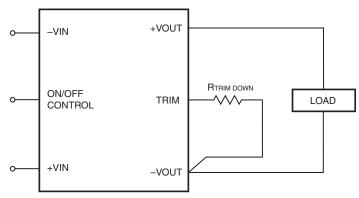


Figure 6. Trim Connections To Decrease Output Voltages. If units have sense pins, connect Trim to (-) Sense pins.

Remote Sense (ULS-3.3/8-D48 and ULS-5/6-D48 models only)

Note: The Sense and Vour 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 +Vour and –Sense to –Vour 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.

$[Vout(+)-Vout(-)] - [Sense(+)-Sense(-)] \le 10\%Vout$

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 Vour 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:

(Vout at pins) x (lout) \leq rated output power

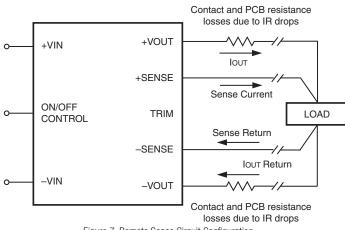


Figure 7. Remote Sense Circuit Configuration

ULS 30-Watt Series

Sixteenth-brick DOSA-Compatible, Isolated DC/DC Converters

Trim Equations

Trim Down

$$R_{T_{DOWN}}(k\Omega) = \frac{511}{\Delta\%} - 10.22$$
Where $\Delta\% = \left| \left(\frac{V_{NOM} - V_{DES}}{V_{NOM}} \times 100 \right) \right|$

Trim Up

	$5.11 \times \text{V}_{\text{NOM}} \times (100 + \Delta\%)$	$-\frac{511}{-10.22}$	
$RT_{UP}(k\Omega) = 1$	1.225 × ∆%	Δ%	

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

"VDES" is the desired, changed output voltage.

ULS 30-Watt Series

Sixteenth-brick DOSA-Compatible, Isolated DC/DC Converters

Trimming by Using an External Voltage Source

1. The easiest way to trim the output using an external voltage source is to drive the Trim pin directly from a variable source. The following equation can be used to calculate the voltage at the Trim pin.

Vtrim =
$$2 \times 1.24 \times \frac{Vo}{Vonominal} - 1.24$$

Vo is the output voltage you want; Vonominal is the nominal output voltage; Vtrim is the voltage that should appear at the trim pin.

2. If the purpose of trimming is to compensate voltage drop of power path from converter to the Load, you may separately connect the sense pin directly to the load. It's much easier than real time adjusting trim voltage.

3. CAUTION: To avoid unplanned power down cycles, do not exceed EITHER the maximum output voltage OR the maximum output power when setting the trim. If the output voltage is excessive, the OVP circuit may shut down the converter. If the maximum power is exceeded, the converter may enter current limiting. If the power is exceeded for an extended period, the converter may overheat and encounter overtemperature shut down. Be careful of external electrical noise. The Trim input is a sensitive input to the converter's feedback control loop. Excessive electrical noise may cause instability or oscillation.

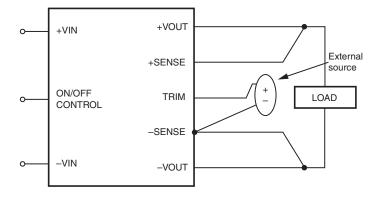


Figure 8. Trimming with an external source

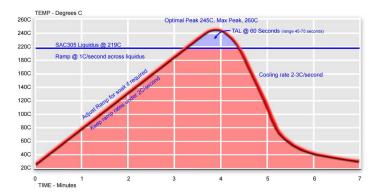
Through-hole Soldering Guidelines

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 quidelines with your process engineers.

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			

SMT Reflow Soldering Guidelines

The surface-mount reflow solder profile shown below is suitable for SAC305 type lead-free 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.



ULS 30-Watt Series

Sixteenth-brick DOSA-Compatible, Isolated DC/DC Converters

Emissions Performance

Murata Power Solutions measures its products for radio frequency emissions against the EN 55022 and CISPR 22 standards. Passive resistance loads are employed and the output is set to the maximum voltage. If you set up your own emissions testing, make sure the output load is rated at continuous power while doing the tests.

The recommended external input and output capacitors (if required) are included. Please refer to the fundamental switching frequency. All of this information is listed in the Product Specifications. An external discrete filter is installed and the circuit diagram is shown below.

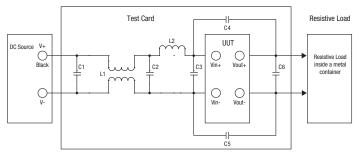


Figure 9. Conducted Emissions Test Circuit

[1] Conducted Emissions Parts List

Reference	Part Number	Description	Vendor
L1	PE-62913	1mH, 6A	Pulse
L2	NC	4.7uH, 3.6A	Murata
C1, C2	VZ Series	Ceramic Capacitor (3.2uf) = 2.2ufd/1ufd in paral- lel, 100V	Panasonic
C3	VZ Series	Qty 2 - Electrolytic Capacitor 22ufd, 100V	Panasonic
C4, C5	Unknown	3.3nF, 1500V	Unknown
C6	VZ Series	Electrolytic Capacitor 33ufd, 100V	Panasonic

[2] Conducted Emissions Test Equipment Used

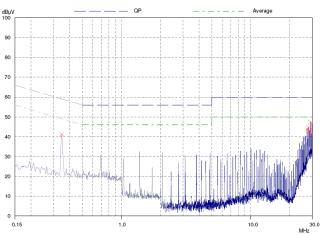
Rohde & Schwarz EMI Test Receiver (9KHz – 1000MHz) ESPC Rohde & Schwarz Software ESPC-1 Ver. 2.20 HP11947A Transient Limiter (Agilent) OHMITE 25W – Resistor combinations DC Source Programmable DC Power Supply Model 62012P-100-50

[3] Layout Recommendations

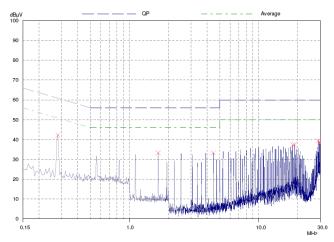
Most applications can use the filtering which is already installed inside the converter or with the addition of the recommended external capacitors. For greater emissions suppression, consider additional filter components and/or shielding. Emissions performance will depend on the user's PC board layout, the chassis shielding environment and choice of external components. Please refer to Application Note GEAN-02 for further discussion.

Since many factors affect both the amplitude and spectra of emissions, we recommend using an engineer who is experienced at emissions suppression.

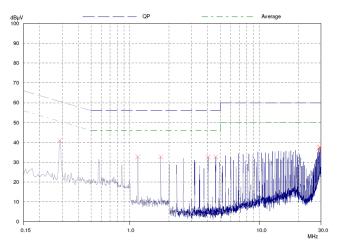




Graph 1. ULS-3.3/8-D48N-C conducted emissions performance, Peak Detection Mode, CISPR/EN55022, Class B, full load at 48Vin



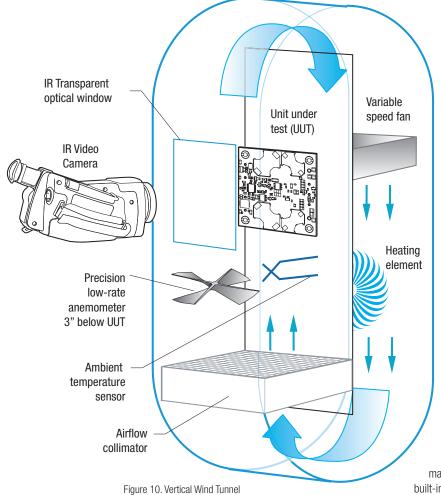
Graph 2. ULS-12/2.5-D48N-C conducted emissions performance, Peak Detection Mode, CISPR/EN55022, Class B, full load at 48Vin



Graph 3. ULS-15/2-D48P-C conducted emissions performance, Peak Detection Mode, CISPR/EN55022, Class B, full load at 48Vin

ULS 30-Watt Series

Sixteenth-brick DOSA-Compatible, Isolated DC/DC Converters



Vertical Wind Tunnel

Murata Power Solutions employs a computer controlled custom-designed 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 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 lnput/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.

Murata Power Solutions, Inc. 129 Flanders Rd. Westborough, Ma 01581, USA. ISO 9001 and 14001 REGISTERED



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