

UL TEST REPORT AND PROCEDURE

Standard:	UL 62368-1, 2nd Ed, 2014-12-01 (Audio/video, information and communication technology equipment Part 1: Safety requirements) CAN/CSA C22.2 No. 62368-1-14, 2nd Ed, Issued: 2014-12-01 (Audio/video, information and communication technology equipment Part 1: Safety requirements)
Certification Type:	Component Recognition
CCN:	QQJQ2, QQJQ8 (Power Supplies for Use in Audio/Video, Information and Communication Technology Equipment)
Complementary CCN:	N/A
Product:	AC-DC Switch mode power supply
Model:	XMS350 or XMS-350, XMS500 or XMS-500, XMS500P or XMS-500P, XMS500A or XMS-500A, XMS500AP or XMS-500AP series switch mode power supplies (see report Model Differences for details)
Rating:	XMS350, XMS-350: 100-240Vac nom, 47-63Hz, 5.3A rms max. XMS500, XMS-500, XMS500P, XMS-500P, XMS500A, XMS-500A, XMS500AP, XMS-500AP: 100-240Vac nom, 47-63Hz, 7A rms max. (see report Model Differences for details and variations)
Applicant Name and Address:	TDK-LAMBDA UK LTD KINGSLEY AVE ILFRACOMBE EX34 8ES UNITED KINGDOM

This is to certify that representative samples of the products covered by this Test Report have been investigated in accordance with the above referenced Standards. The products have been found to comply with the requirements covering the category and the products are judged to be eligible for Follow-Up Service under the indicated Test Procedure. The manufacturer is authorized to use the UL Mark on such products which comply with this Test Report and any other applicable requirements of UL LLC ('UL') in accordance with the Follow-Up Service Agreement. Only those products which properly bear the UL Mark are considered as being covered by UL's Follow-Up Service under the indicated Test Procedure.

The applicant is authorized to reproduce the referenced Test Report provided it is reproduced in its entirety.

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Any information and documentation involving UL Mark services are provided on behalf of UL LLC (UL) or any authorized licensee of UL.

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Handler

Reviewed By: Dennis Butcher / Reviewer

Supporting Documentation

The following documents located at the beginning of this Procedure supplement the requirements of this Test Report:

A. Authorization - The Authorization page may include additional Factory Identification Code markings.

B. Generic Inspection Instructions -

- i. Part AC details important information which may be applicable to products covered by this Procedure. Products described in this Test Report must comply with any applicable items listed unless otherwise stated in the body of this Test Report.
- ii. Part AE details any requirements which may be applicable to all products covered by this Procedure. Products described in this Test Report must comply with any applicable items listed unless otherwise stated in the body of each Test Report.
- iii. Part AF details the requirements for the UL Certification Mark which is not controlled by the technical standard used to investigate these products. Products are permitted to bear only the Certification Mark(s) corresponding to the countries for which it is certified, as indicated in each Test Report.

Product Description

XMS350 or XMS500 series switch mode power supplies

(See Model Differences for details and variations)

The series consists of two power outputs, a 350W and 500W, these use the same topology with some component variations.

The XMS series switch mode power supply consists of:

1. Input filter, consisting of the input fuse(s), X and Y capacitors, common mode chokes up to the bridge and series choke after the bridge.
2. PFC (boost circuit), consisting of the boost choke and associated switching FETs/circuitry.
3. Forward converter, consisting of the main transformer and switching FETs/circuitry supplying channel 1 and fan supply outputs.
4. Standby circuit, consisting of the standby transformer and switching IC/circuitry supplying the standby output.
5. Secondary circuits (ES1 and ES2 as applicable), consisting of channel 1 output, standby output, fan supply (derived from the channel 1 output), power OK and inhibit/enable.

Model Differences

XMS350 or XMS500 series (may also be marked as XMS-350 or XMS-500) as described below:

Units may be marked with a Product Code: Xy where y may be any number of characters.

Unit Configuration Code (Description): may be prefixed with NS # or K # followed by / or - (where # may be any number of characters indicating non-safety related model differences).

Unit Configuration Code (Description): may be prefixed by SP followed by / or – (where SP represents a sales code)

Unit Configuration (Description)

XMSxy-a-bc-defghijklm

where:

- x = 350 for 350W model
500 for 500W model
500A for enhanced 500W model (less than 1W inhibited)
500P for 576W peak power models (36V, 40V and 48V output models only)
500AP for enhanced 500W model with 576W peak power (36V, 40V and 48V output models only)
- y = Blank for Class I
D for Class II
- a = Channel 1 Output Voltage (see Ch1 in the table below, adjustment range column).
- b = Standby Output Voltage: see standby voltage in table below
N for no supply
5 for 5 volt
12 for 12 volt
- c = Standby Output Current†:
C for 0.5A
M for 1.0A
H for 2.0A
N for no supply or 0 amps output
- d = Fan Supply†:
N for no fan supply (customer cooling)
N1 for 24V fan supply (customer cooling)
N2 for 12V variable supply
N3 for 12V fixed supply
KF for non-standard top fan
TF for top-fan
- e = U for non-standard U chassis
P for perforated frame
N for Open Frame
C for custom chassis/covers for non-standard models
S for standard U chassis
B for standard U chassis with perforated cover
- f = Touch (Enclosure) current:
B for <100uA
T for <75uA
- g = Earth leakage current:

D for Class II (no Earth)
L for <300uA
R for <150uA
T for <100uA

h = E or In for inhibit
T or En for enable

i = A for AC OK option
N for no AC OK option
P for Power Good Option (500A or 500PA models only)

j = Blank for dual fuses fitted
FL for single fuse fitted in the Live line

klm = Blank for standard output settings

May be three numbers from 0 to 9 (preceded by -) which denotes various output voltage/current settings within the specified ranges of each output for a particular unit. (may define non-safety related parameters/feature, e.g. reduced primary current limit, reduced OVP)

Input Parameters

Nominal input voltage 100 - 240 Vac
Input voltage range 85 - 264 Vac
Input frequency range 47 - 63 Hz
Maximum input current 7A (5.3A*) rms

* Input for 350W models.

All ratings apply for ambient temperatures up to 50°C.

At 85Vac the following deratings apply to all XMS500 TF models: 500W output power at 40°C ambient or 400W output power at 50°C ambient.

Output Parameters

†Output ratings are in accordance with the following table:

Standard models:

Output Channel	Voltage Designation	Vout nom.(V)	Adjustment Range (V)	Output Current (A)	Output Power (W)
CH1 (500W)	12	12	11.6 - 13.2	41.6	500
	24	24	23.8 - 25.2	20.8	500
	36	36	35.4 - 37.8	13.8(16*)	500(576*)

	40	40	38 - 42	12.5(15.16*)	500(576*)
	48	48	47-50	10.4(12*)	500(576*)
CH1 (350W)	24	24	23.8 - 25.2	14.6	350
Standby Option	5	5	5 - 5.5	0.5	2.75
	5	5	5 - 5.5	2.0	11.0
	12	12	12-13.2	1	13.2
	N	10	5 - 15	0	0
Fan Supply	N	-	-	-	-
	N1	24	Fixed	0.2	4.8
	N2	12	6-12	-	3.0
	N3	12	Fixed	0.25	3.0

*576W peak power up to 2 minutes with 500Wrms power using the following formula:

$$500Wrms = ((peakpower^2 \times T1 + reducedpower^2 \times T2)/(T1 + T2))^{1/2}$$

Where T1 = peak power time on in seconds

T2 = reduced power time on in seconds

Non-Standard Models:

X00011#	XMS350-24-NN-N1CBLEN	Customer specific chassis
X00023#	XMS500D-24.5-5C-KFCBDEN	Customer specific top fan/chassis model
X00073#	XMS500-24-NN-NCBRInA	Customer specific chassis/cover

Where # can be any letter denoting non-safety related changes.

Output Limitations:

The following outputs are ES1: 12, 24, 36, 40V

The following outputs are ES2: 48V

Test Item Particulars

Classification of use by	Skilled person
Supply Connection	AC Mains
Supply % Tolerance	+10%/-10%

Supply Connection – Type	mating connector
Considered current rating of protective device as part of building or equipment installation	20 A; building;
Equipment mobility	for building-in
Over voltage category (OVC)	OVC II
Class of equipment	Class I Class II
Access location	N/A
Pollution degree (PD)	PD 2
Manufacturer's specified maximum operating ambient (°C)	50°C
IP protection class	IPX0
Power Systems	TN TT
Altitude during operation (m)	5000 m
Altitude of test laboratory (m)	2000 m or less
Mass of equipment (kg)	1kg max

Technical Considerations

- The product was submitted and evaluated for use at the maximum ambient temperature (T_{ma}) permitted by the manufacturer's specification of : 50 °C
- The product is intended for use on the following power systems : TN,TT
- Considered current rating of protective device as part of the building installation (A) : 20
- Mains supply tolerance (%) or absolute mains supply values : +10%/-10%
- The equipment disconnect device is considered to be : Provided in the end-product
- The following were investigated as part of the protective earthing/bonding : Printed wiring board trace (refer to Enclosure - Schematics + PWB for layouts)
- The following are available from the Applicant upon request : Installation (Safety) Instructions / Manual
- Multi-layer PWBs accepted under CBTR Ref. No. E349607-A23 dated 2014-07-31 and letter report in Enclosure 8-01.
- The following output terminals were referenced to earth during performance testing: All outputs and their return lines individually referenced to earth to obtain maximum working voltage.

Engineering Conditions of Acceptability

For use only in or with complete equipment where the acceptability of the combination is determined by UL LLC. When installed in an end-product, consideration must be given to the following:

- The following product-line tests are conducted for this product : Electric Strength, Earthing Continuity (except for XMSxD model)
- The end-product Electric Strength Test is to be based upon a maximum working voltage of : Primary – Earthed Dead Metal: 365Vrms, 632Vpk; Primary-Secondary: 405Vrms, 655Vpk
- The following output circuits are at ES1 energy levels : 12, 24, 36, 40V models
- The following output circuits are at PS3 energy levels : All circuits
- The maximum investigated branch circuit rating is : 20 A
- The investigated Pollution Degree is : 2
- Proper bonding to the end-product main protective earthing termination is : Required (except for the XMSxD model)
- An investigation of the protective bonding terminals has : been conducted
- The following end-product enclosures are required : Mechanical, Electrical, Fire
- The following magnetic devices (e.g. transformers or inductor) are provided with an OBJY2 insulation system with the indicated rating greater than Class A (105°C) : TX1 Class F. TX3 (Class B or F) see table 1.5.1 for details of insulation systems used.
- The power supply was evaluated to be used at altitudes up to : "5,000 m"
- The power supply terminals and/or connectors are: Not investigated for field wiring.
- All models require component temperatures monitored as detailed in the additional information (except -KF and -TF fan models)
- The product was tested for use at the maximum ambient temperature (TMA) 50°C in normal conditions permitted by the manufacturer, see additional information for details.
- The Customer fixings screw penetration require special attention: see handbook in enclosures for details.

Additional Information

Cooling for units with customer supplied air (all models except KF and TF fan supplies)

The following method must be used for determining the safe operation of PSUs.

The components listed in the following table must not exceed the temperatures given. To determine the component temperatures the heating tests must be conducted in accordance with the requirements of the standard in question. Consideration should also be given to the requirements of other safety standards. Test requirements include: PSU to be fitted in its end-use equipment and operated under the most adverse conditions permitted in the end-use equipment handbook/specification and which will result in the highest temperatures in the PSU. To determine the most adverse conditions consideration should be given to the end use equipment maximum operating ambient, the PSU loading and input voltage, ventilation, end use equipment orientation, the position of doors & covers etc. Temperatures should be monitored using type K fine wire thermocouples (secured with cyanoacrylate adhesive or similar) placed on the hottest part of the component (out of any direct airflow) and the equipment should be run until all temperatures have stabilized.

Cooling for unit temperature table:

Circuit Ref:	Description	Max. Temperature (°C)
J1	Input Connector	105
C7, C8	X Capacitor	100
L2, L4	Common Mode Choke Winding	130 (145)
L6	Series Mode Choke Winding	130
ASY5 D7	Bridge Diode	125 (130)
C14, C11, C21, C22, C10, C23, C24, C6, C18 (++)	Y Capacitors	100
C26	Capacitor	85 (105)

RLY1	Relay	100
U1, U2, U5, U6, U7 (++)	Opto-Coupler	100
TX1 (Standby)	Windings and core	120 (130)
TX3 500W	Windings and core	120 (130)
TX3 350W	Windings and core	100 (110)
ASY6 Q3	Boost FET	127 (130)
ASY4 Q1	Forward FET	127 (130)
ASY3 Q4	Output FET	127 (130)
C13	Boost Capacitor	80 (105)
C9	Boost Capacitor	70 (105)
L3, L5	Boost Choke Winding	130 (140)
L7	Channel 1 Output Choke	130 (140)
C4, C5, C15, C16, C17 C19, C20 (++)	Electrolytic Capacitors	80 (105)

+ The higher temperature limits in brackets may be used but product life may be reduced.
++ When fitted

The marking label provided is representative of all models.

The test item receipt dates shown are those of the original/ amendment testing.

Additional Standards

The product fulfills the requirements of: EN 62368-1:2014 + A11:2017, CSA CAN/CSA-C22.2 No. 62368-1 2nd Edition, Issued December 1, 2014, UL 62368-1 2nd Edition, Issued December 1, 2014

Markings and Instructions

Clause Title	Marking or Instruction Details
Equipment identification marking – Manufacturer identification	Listee's or Recognized companys name, Trade Name, Trademark or File Number
Equipment identification marking – model identification	Model Number
Equipment rating marking – ratings	"Input Ratings (voltage, frequency/dc, current/power)", "Output Ratings (voltage, frequency/dc, current/power)"

Special Instructions to UL Representative

N/A