

UL TEST REPORT AND PROCEDURE

Standard:	UL 60950-1, 2nd Edition, 2014-10-14 (Information Technology Equipment - Safety - Part 1: General Requirements) CAN/CSA C22.2 No. 60950-1-07, 2nd Edition, 2014-10 (Information Technology Equipment - Safety - Part 1: General Requirements)
Certification Type:	Component Recognition
CCN:	QQGQ2, QQGQ8 (Power Supplies for Information Technology Equipment Including Electrical Business Equipment)
Product:	Switch mode power supply
Model:	XMS350 or XMS-350 and XMS500 or XMS-500 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: 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 AVENUE ILFRACOMBE DEVON 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.

UL authorizes the applicant to reproduce the latest pages of the referenced Test Report consisting of the first page of the Specific Technical Criteria through to the end of the Conditions of Acceptability.

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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Reviewed by: David Snook - 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 (SELV), consisting of channel 1 output, standby output, fan supply, 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 # followed by / or - (where # may be any number of characters indicating non-safety related model differences).

Unit Configuration (Description)

XMSxy-a-bc-defghijklm

where:

- x = 350 for 350W model
- 500 for 500W model
- 500P for 576W peak power models (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
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 90 - 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.

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:

All outputs are SELV
Channel 1 is hazardous energy

Technical Considerations

- Equipment mobility : for building-in
- Connection to the mains : Connection to the mains via host equipment
- Operating condition : continuous
- Access location : For building in
- Over voltage category (OVC) : OVC II
- Mains supply tolerance (%) or absolute mains supply values : +10%, -10%
- Tested for IT power systems : No
- IT testing, phase-phase voltage (V) : N/A
- Class of equipment : Class I (earthed) and Class II models (double insulated)
- Considered current rating of protective device as part of the building installation (A) : 20A
- Pollution degree (PD) : PD 2
- IP protection class : IP X0
- Altitude of operation (m) : 5000m
- Altitude of test laboratory (m) : 64m
- Mass of equipment (kg) : 1kg max
- 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
- The equipment disconnect device is considered to be: provided by the end equipment
- 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 8-07

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 Production-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-SELV: 405Vrms, 655Vpk, Primary-Earthed Dead Metal: 365Vrms, 632Vpk
- The following secondary output circuits are SELV: All
- The following secondary output circuits are at hazardous energy levels: Channel 1
- The following secondary output circuits are at non-hazardous energy levels: Standby output, fan output
- 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.

- The power supply terminals and/or connectors are: Not investigated for field wiring
- 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 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 following end-product enclosures are required: Mechanical, Fire, Electrical
- 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)

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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

Additional Standards

The product fulfills the requirements of: UL60950-1, 2nd Edition, 2014-10-14, CSA C22.2 No. 60950-1-07+A1 +A2:2014, 2nd Edition, 2014-10, EN 60950-1:2006 + A1:2010 + A11:2009 + A12:2011 +A2:2013