UL TEST REPORT AND PROCEDURE

Standard:	UL 60950-1, 1st Edition, 2007-10-31 (Information Technology Equipment - Safety - Part 1: General Requirements) CSA C22.2 No. 60950-1-03, 1st Edition, 2006-07 (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:	Power Supply, DC-DC converter
Model:	iPAQGxxxx is iQG48***A%%%V-xxx Generic Series, iQG4N***A%%%V-xxx Generic Series Examples of model designation: iQG48025A120V-xxx iQG48027A110V-xxx iQG48031A096V-xxx iQG48036A083V-xxx iQG48033A124V-XXX iQG48033A120V-xxx iQG48033A110V-xxx iQG48038A096V-xxx iQG48040A080V-xxx iQG48035A080V-xxx iQG48047A096V-xxx iQG4N050A096V-xxx iQG4N050A108V-xxx iQG48042A120V-xxx iPAQGxxxx is a iQG48***A%%%V-xxx or iQG4N***A%%%V-xxx, where xxxx is a four digit number or alphanumeric character indicating a mechanical function, such as addition of Heatsink. where *** represents a three digit output current between 25A - 50A; where %%% represents a three digit output voltage between 8.0V-12.4Vdc, where xxx is a three digit number or alphanumeric character indicating a mechanical or control function modification.
Rating:	iPAQGxxxx is a iQG48***A%%%V-xxx or iQG4N***A%%%V-xxx, where xxxx is a four digit number or alphanumeric character indicating a mechanical function, such as addition of Heatsink.

iQG48***A%%%V-xxx
Generic Input: 36 - 75V dc, 10A max,
Generic Output: 8.0 - 12V dc, 25A - 36A, 300W max.

iQG48***A%%%V-xxx
Generic Input: 36 - 75V dc, 11.5A max,
Generic Output: 8.0 - 12.4V dc, 30A - 40A, 400W max.

iQG48***A%%%V-xxx
Generic Input: 36 - 75V dc, 12A max,
Generic Output: 8.0 - 10.8V dc, 33A - 50A, 480W max.

iQG48***A%%%V-xxx
Generic Input: 39 - 75V dc, 15A max,
Generic Output: 8.0 - 12V dc, 33A - 50A, 504W max.

iQG4N***A%%%V-xxx
Generic Input: 38 - 56V dc, 12.5A max,
Generic Output: 8.0 - 11.4V dc, 33A - 50A, 540W max.

Input: 36V - 75V dc, 10A max,
dc output max 300 watts
iQG48025A120V-xxx = 12V dc, 25A
iQG48027A110V-xxx = 11V dc, 27A
iQG48031A096V-xxx = 9.6V dc, 31A
iQG48036A083V-xxx = 8.3V dc, 36A

Input: 36V - 75V dc, 11.5 A max,
dc output max 400 Watts
iQG48033A124V-xxx = 12.4V dc, 33A
iQG48033A120V-xxx = 12V dc, 33A
iQG48033A110V-xxx = 11V dc, 33A
iQG48038A096V-xxx = 9.6V dc, 38A
iQG48040A080V-xxx = 8.0V dc, 40A
iQG48035A080V-xxx = 8.0V dc, 35A

Input: 36V-75Vdc, 12A max,
dc output max 450 Watts
iQG48047A096V-xxx = 9.6V dc, 47A, 451 W

Input: 38V-56Vdc, 12A max,
dc output max 480 Watts
iQG4N050A096V-xxx = 9.6V dc, 50A, 480 W

Input: 51V-56Vdc, 12.5A max,
dc output max 540 Watts
iQG4N050A108V-xxx = 10.8Vdc, 50A, 540 W.

iQG48042A120V
Input: 39V-75Vdc, 15A max
Output: 12Vdc, 42A, 504W max

	where *** represents a three digit output current between 25A - 50A; where %%% represents a three digit output voltage between 8.0V-12.4Vdc, where xxx is a three digit number or alphanumeric character indicating a mechanical or control function modification.
Applicant Name and Address:	TDK-LAMBDA AMERICAS INC SUITE 100 3320 MATRIX DR RICHARDSON TX 75082 UNITED STATES

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.

Prepared by: Rupi Dhadda Reviewed by: Gregory Ray

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

The product is a component type DC/DC power module with a planar type power transformer. The converter is provided with input terminal pins for factory installation onto a printed wiring board with a connection to a dc source of supply and output terminal pins. These models have been evaluated as having Basic insulation from input to output. The product employs a multilayer PWB planar transformer.

Model Differences

All Models covered within this report iQG48***A%%%V-xxx Generic Series, iQG4N***A%%%V-xxx Generic Series are identical, the individual models covered within the series are created by following changes:
-Output V, A and VA rating ranging from 8V to 12Vdc; 25A to 36A, 300W max respectively, and
-Output V, A and VA rating ranging, from 8V to 12.4Vdc; 30A to 40A; 400W max respectively, and
-Output V, A and VA rating ranging, from 8V to 12Vdc; 33A to 50A; 480W-540W max respectively.

- iPAQGxxxx is a iQG48***A%%%V-xxx or iQG4N***A%%%V-xxx,
where xxxx is a four digit number or alphanumeric character indicating a mechanical function, such as addition of Heatsink.

1. XDX option for Droop circuit, Output Voltage at higher than nominal and decreasing as Output Current increases to rated current, see manufacturers data sheet for details.
2. Maximum input current will be a data sheet parameter telling the customer the maximum current the power module will draw from 0Vin to Vin,max. The typical current draw will be lower. The power modules are not internally fused. An external input line fuse with a maximum value of 20A is required.
3. The output voltage can be adjusted in iQG products when the trim pin is populated (optional).

- See Miscellaneous Enclosure Attachment - iQG Series spec sheet.

-Output V, A and VA rating ranging from 8.32V to 12V dc; 36A to 25A, 300W max respectively, and Output V, A and VA rating ranging, from 9.6 V, to 10.8 V; 47A to 50 A; 450 W, 540 W respectively

-The core gap for the output inductor may also be changed according to the output current variation. The core material and the structure of the output inductors will remain same.

-The power semiconductor devices such as the secondary FETs, Q401 to Q403 and Q411 to Q413, will be in the same physical package but with different voltage rating depending upon the specific voltage and current stresses in the various power module designs.

-The output filter capacitors C601 to C606 will also be in the same packages but may be different values and voltage ratings depending upon the specific voltage and current stresses in the various module designs.

-Control circuits will have value changes to scale the typical circuit parameters such as output voltage and output current limit set point as required for the different designs. Other control circuits such as the feedback compensation may have value changes as required for each specific design.

Models IQG480 Series, 400 Watts family and previously evaluated IQG480, 300 Watts family are identical, except the gap of the output inductor cores; primary and secondary FETS voltage ratings; main transformer cores and turn ratios; and PWB design.

Models IQG product family 450W/540W are similar to previously evaluated IQG480 Series,(300 and 400 Watts), except for the following: 1) Main transformer turns ratio 2) the gap of the output inductor cores used in iQG 450W/540W series is slightly larger due to increased load current; 3) the secondary FETs used are of lower voltage rating (60V)

4) an optional trim pin is added in iQG 450W/540W code; 6) 450W/540W modules having a voltage droop feature built-in where the output voltage droop as the load current increasing (10mV ~ 20mV /A).

Technical Considerations

- Equipment mobility : for building-in
- Operating condition : continuous
- Mains supply tolerance (%) : No direct connection
- Tested for IT power systems : No
- IT testing, phase-phase voltage (V) : N/A
- Class of equipment : Special Application - TNV-2
- Mass of equipment (kg) : less than 1 kg
- Protection against ingress of water : IP X0
- The product was submitted and evaluated for use at the maximum ambient temperature (Tma) permitted by the manufacturer’s specification of: 25°C
- The means of connection to the mains supply is: building-in
- The following are available from the Applicant upon request: Installation (Safety) Instructions / Manual

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 end-product Electric Strength Test is to be based upon a maximum working voltage of: 136 Vpk or 75V dc
- The following secondary output circuits are SELV: All Outputs, single output units
- The following secondary output circuits are at hazardous energy levels: All Output, single output units
- The power supply terminals and/or connectors are: Suitable for factory wiring only
- The maximum investigated branch circuit rating is: 20 A ,

- The investigated Pollution Degree is: 2
- An investigation of the protective bonding terminals has: Not been conducted
- The following end-product enclosures are required: Mechanical, Fire, Electrical
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This equipment has been evaluated to ensure basic insulation between Special Application - TNV-2 input and output. The maximum input voltage does not exceed 75Vdc. Input Voltage range declared by the manufacturer is 36-75 Vdc.

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Consideration should be given to conducting the Heating Test in the End Product. The following components require special consideration during end-product Heating test: Transformer (T1) which is integrated within the PWB.

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The power supply shall be installed in compliance with the enclosure, mounting, spacing, and segregation requirements of the ultimate application.

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The Heating test was conducted with the power supply mounted in a vertical position on its side, in a wind tunnel with forced air cooling of 200LFM, air flow upwards, fan mounted ~65cm away from the EUT on all Models with max output of 300W. The Heating test was conducted with the power supply mounted in a vertical position on its side, in a wind tunnel with forced air cooling of 400LFM, air flow upwards, fan mounted ~65cm away from the EUT on all Models with max output of 400W. The Heating test was conducted with the power supply mounted in a vertical position on its side, in a wind tunnel with forced air cooling of 250LFM, air flow upwards, fan mounted ~65cm above the EUT on Model iQG48047A096V-xxx for units with max output of 451W, and similarly Heating test on Model iQG4N050A108V-xxx was conducted with the power supply mounted in a vertical position on its side, in a wind tunnel with forced air cooling of 350LFM, air flow upwards, fan mounted ~65cm above the EUT for units with max output of 540W. iQG48042A120V-xxx: Tests conducted in wind tunnel with 450 LFM. All tests done with base plate attached to unit.

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The input-output connectors are not acceptable for field connections and are only intended for connection to mating connectors of internal wiring inside the end use machine. The acceptability of these and the mating connectors relative to securement, insulating materials, and temperature shall be considered in the end product.

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The power supply is intended to be supplied by isolated secondary circuitry in an end product application.

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For output to be SELV, input must be from a source that is isolated from the mains(utility) by reinforced insulation.

Additional Information

From a schematic perspective the models are the same except for component value changes in the voltage loop and trim portions of the converter

Markings and instructions

Clause Title	Marking or Instruction Details
Power rating - Ratings	Ratings (voltage, frequency/dc, current)
Power rating - Company identification	Listee's or Recognized company's name, Trade Name, Trademark or File Number
Power rating - Model	Model Number

Special Instructions to UL Representative

N/A

Production-Line Testing Requirements

Electric Strength Test Special Constructions - Refer to Generic Inspection Instructions, Part AC for further information.

Model	Component	Removable Parts	Test probe location	V rms	V dc	Test Time, s
-	-	-	-	-	-	-

Earthing Continuity Test Exemptions - This test is not required for the following models:

All models in this report

Electric Strength Test Exemptions - This test is not required for the following models:

Electric Strength Test Component Exemptions - The following solid-state components may disconnected from the remainder of the circuitry during the performance of this test:

Sample and Test Specifics for Follow-Up Tests at UL

Model	Component	Material	Test	Sample(s)	Test Specifics
N/A	-	-	-	-	-