



Test Report issued under the responsibility of:



**TEST REPORT**  
**IEC 60950-1**  
**Information technology equipment – Safety –**  
**Part 1: General requirements**

**Report Number** .....: 215009-CI3-1 CB DE1-55984  
**Date of issue** .....: 2015-07-31  
**Total number of pages**.....: 178

**Applicant's name**.....: TDK-Lambda American Inc.  
**Address** .....: 3320 Matrix Drive, Suite 100, Richardson, Texas 75082, USA

**Test specification:**

**Standard** .....: DIN EN 60950-1 (VDE 0805-1):2014-08  
EN 60950-1:2006 +A11:2009 +A1:2010 +A12:2011+A2:2013  
IEC 60950-1:2005 (Second Edition) + Am 1:2009 + Am 2:2013  
**Test procedure** .....: VDE, CB Scheme  
**Non-standard test method**.....: N/A

**Test Report Form No**.....: IEC60950\_1F  
**Test Report Form(s) Originator**.....: SGS Fimko Ltd  
**Master TRF** .....: Dated 2014-02

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**General disclaimer:**

The test results presented in this report relate only to the object tested.  
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<p><b>Test item description</b>..... :</p> <p><b>Trade Mark</b>..... :</p> <p><b>Manufacturer</b> .....</p> <p><b>Model/Type reference</b> .....</p>	<p>DC - DC Converter for building in</p> <p><b>TDK-Lambda</b></p> <p>TDK-Lambda American Inc.</p> <p><b>Models:</b>  HQA24***A%%V-xxx(-S)(-?)  where 24 represents nominal input voltage, with a 18-40Vdc input  *** represents rated output current between 0A – 2.5A,  %%V represents rated output voltage ,48Vdc, with Max Output Power of 120W  and xxx indicates a number or alphanumeric character which affects non safety related features  Optional–S indicating standard, or –M indicating enhanced, with optional –? (indicating Non safety related option) following the previous option</p> <p>HQA2W***A%%V-xxx(-S)(-?)  where 2W represents nominal input voltage, with a 9-40Vdc input, with a Max Input Current of 16A  *** represents rated output current between 2.5A – 35A,  %%V represents rated output voltage between,3.3Vdc - 28Vdc, with Max Output Power of 120W  and xxx indicates a number or alphanumeric character which affects non safety related features  Optional–S indicating standard, or –M indicating enhanced, with optional –? (indicating Non safety related option) following the previous option</p>
<p><b>Ratings</b>..... :</p> <p>10003893 Rated voltage.....:</p> <p>10004017 Rated current.....:</p> <p>10003951 Output voltages and currents.....:</p> <p>10004009 Class.....:</p> <p>10005550 Insulation class.....:</p> <p>10004092 Max. ambient temperature...:</p> <p>10004046 Remark(s).....:</p>	<p>DC 9 – 40 V SELV, ELV, TNV</p> <p>Max. 16 A</p> <p>SELV, ELV, TNV</p> <p>I</p> <p>Basic Insulation</p> <p>130°C max at Q15</p> <p>When the certified product is built in, the installation must be in accordance with the provided installation instructions and the requirements of the referenced standard(s) have to be met.</p>
<p>Supplementary information:  The above listing was introduced only for internal VDE administration process.</p>	

<b>Testing procedure and testing location:</b>		
<input checked="" type="checkbox"/>	<b>CB Testing Laboratory:</b>	VDE Prüf- und Zertifizierungsinstitut GmbH VDE <i>Testing and Certification Institute</i>
<b>Testing location/ address.....:</b>		Merianstrasse 28, D-63069 Offenbach, Germany
<input type="checkbox"/>	<b>Associated CB Testing Laboratory:</b>	
<b>Testing location/ address.....:</b>		
<b>Tested by (name + signature).....:</b>		(authorization of test report)
<b>Approved by (name + signature).....:</b>		
<hr/>		
<input type="checkbox"/>	<b>Testing procedure: TMP/CTF Stage 1:</b>	
<b>Testing location/ address.....:</b>		
<b>Tested by (name + signature).....:</b>		(authorization of test report)
<b>Approved by (name + signature).....:</b>		
<hr/>		
<input checked="" type="checkbox"/>	<b>Testing procedure: WMT/CTF Stage 2:</b>	
<b>Testing location/ address.....:</b>		
<b>Tested by (name + signature).....:</b>		Steve Mckitrick 
<b>Witnessed by (name + signature).....:</b>		Frank Richter (authorization of test report) 
<b>Approved by (name + signature).....:</b>		U.Schafranka 
<hr/>		
<input type="checkbox"/>	<b>Testing procedure: SMT/CTF Stage 3 or 4:</b>	
<b>Testing location/ address.....:</b>		
<b>Tested by (name + signature).....:</b>		
<b>Witnessed by (name + signature).....:</b>		
<b>Approved by (name + signature).....:</b>		
<b>Supervised by (name + signature).....:</b>		

<b>Summary of testing:</b>	
<p><b>Tests performed (name of test and test clause):</b></p> <ul style="list-style-type: none"> <li>1.5 Components</li> <li>1.6 Power interface</li> <li>1.7 Marking and instructions</li> <li>2.2 SELV circuits</li> <li>2.3 TNV circuits</li> <li>2.9 Electrical insulation</li> <li>2.10 Clearances, creepage distances and distances through insulation</li> <li>4.2 Mechanical strength</li> <li>4.3 Design and construction</li> <li>4.5 Thermal requirements</li> <li>4.7 Resistance to fire</li> <li>5.2 Electric strength</li> <li>5.3 Abnormal operating and fault conditions</li> </ul> <p><b>Testing Plan:</b></p> <p>Our intention is to approve the entire power module platform as listed in Table 1 by testing a minimal number of products. For safety testing, we intend to provide samples of the <b>HQA2W120W280V and HQA24120W480V</b>. Our expectation is that testing of this highest output voltage, highest input current, widest input voltage range should provide safety approval for the product codes listed in the product matrix <b>Models listed above and Table 1 Examples</b>.</p> <p>We would like to obtain approval to the following standards: <b>UL60950 Edition 2</b> ( VDE0805), CB scheme (IEC60950), CE mark (EN60950).</p> <p>We would like to have an approval for our product as a <b>basic insulation</b> device with 2250Vdc isolation</p>	<p><b>Testing location:</b></p> <p>TDK-Lambda American Inc.  3320 Matrix Drive, Suite 100, Richardson, Texas  75082, USA  WMT (TDAP File no. 2520400-9501-0001)</p>

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**TEST SAMPLE IDENTIFICATION**

The table below is to provide correlation of sample numbers to specific product related information. Refer to this table when a test identifies a test sample by "Sample No." only.

Sample Number	Sample Card Number	Date Received	Manufacturer, Product Identification and Ratings
P0005	HQ2021442P0005	2015-05-08	TDK-Lambda Americas, Inc., HQA2W120W280V-0XX Input: 10-40Vdc, 16Adc max. , Output: 28Vdc, 4.25Adc, 120W (Non – potted)
P0012	HQ2021442P0012	2015-05-08	TDK-Lambda Americas, Inc., HQA2W120W280V-0XX Input: 10-40Vdc, 16Adc max. , Output: 28Vdc, 4.25Adc, 120W (Non – potted)
P0024	HQ2021442P0024	2015-05-08	TDK-Lambda Americas, Inc., HQA2W120W280V-0XX Input: 10-40Vdc, 16Adc max. , Output: 28Vdc, 4.25Adc, 120W (fully potted)
P0002	HQ2011407P0002	2015-05-19	TDK-Lambda Americas, Inc., HQA24120W480V-0XX Input: 18-40Vdc, 16Adc max. , Output: 48Vdc, 2.5Adc, 120W (Non – potted)
P0004	HQ2011407P0004	2015-05-19	TDK-Lambda Americas, Inc., HQA24120W480V-0XX Input: 18-40Vdc, 16Adc max. , Output: 48Vdc, 2.5Adc, 120W (Non – potted)
P0001	HQ2021442P0001	2015-05-08	TDK-Lambda Americas, Inc., HQA2W120W280V-0XX Input: 10-40Vdc, 16Adc max. , Output: 28Vdc, 4.25Adc, 120W (fully potted)
Unit 1, Unit 2, Unit 3	ZB00421	2015-06-22	TDK-Lambda Americas, Inc., HQA2W120W280V-0XX Input: 10-40Vdc, 16Adc max. , Output: 28Vdc, 4.25Adc, 120W Bare Boards
HQ2021511P0 005	HQ2021511P0005	2015-06-22	TDK-Lambda Americas, Inc., HQA2W120W280V-0XX Input: 10-40Vdc, 16Adc max. , Output: 28Vdc, 4.25Adc, 120W (fully potted)
P0006	HQ2021511P0006	2015-06-22	TDK-Lambda Americas, Inc., HQA2W120W280V-0XX Input: 10-40Vdc, 16Adc max. , Output: 28Vdc, 4.25Adc, 120W (fully potted)
Sampling Procedure (if used) :		N/A	

<b>Summary of compliance with National Differences:</b>				
<b>List of countries addressed</b>				
The product has been tested according to standard IEC 60950-1:2005 (2 <sup>nd</sup> Edition); am1:2009; am2:2013 / EN 60950-1:2006; A11:2009; A1:2010; A12:2011; A2:2013 and those deviations taken into account of				
<input checked="" type="checkbox"/> CENELEC common modifications	<input checked="" type="checkbox"/> United Kingdom	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/> Finland	<input checked="" type="checkbox"/> Denmark	<input checked="" type="checkbox"/> Ireland	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/> Sweden	<input checked="" type="checkbox"/> Germany	<input checked="" type="checkbox"/> Spain	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/> Norway	<input checked="" type="checkbox"/> Switzerland	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b><input checked="" type="checkbox"/> CB Bull. NATIONAL DIFFERENCES IEC 60950-1:2005 (2nd Edition)</b>				
<input checked="" type="checkbox"/> Switzerland	<input checked="" type="checkbox"/> Finland	<input checked="" type="checkbox"/> Norway	<input checked="" type="checkbox"/> USA	<input checked="" type="checkbox"/> Japan
<input checked="" type="checkbox"/> Germany	<input checked="" type="checkbox"/> United Kingdom	<input checked="" type="checkbox"/> Sweden	<input checked="" type="checkbox"/> Israel	<input type="checkbox"/>
<input checked="" type="checkbox"/> Denmark	<input checked="" type="checkbox"/> Ireland	<input checked="" type="checkbox"/> Group Differences	<input checked="" type="checkbox"/> Australia	<input type="checkbox"/>
<input checked="" type="checkbox"/> Spain	<input checked="" type="checkbox"/> Korea	<input checked="" type="checkbox"/> Canada	<input checked="" type="checkbox"/> New Zealand	<input type="checkbox"/>
<b><input checked="" type="checkbox"/> The product fulfils the requirements of</b>				
DIN EN 60950-1 (VDE 0805-1):2014-08 EN 60950-1:2006 +A11:2009 +A1:2010 +A12:2011+A2:2013 IEC 60950-1:2005 (Second Edition) + Am 1:2009 + Am 2:2013				

<b>Test item particulars</b> .....:	
<b>Equipment mobility</b> .....:	<input type="checkbox"/> movable <input type="checkbox"/> hand-held <input type="checkbox"/> transportable <input type="checkbox"/> stationary <input checked="" type="checkbox"/> for building-in <input type="checkbox"/> direct plug-in
<b>Connection to the mains</b> .....:	<input type="checkbox"/> pluggable equipment <input type="checkbox"/> type A <input type="checkbox"/> type B <input type="checkbox"/> permanent connection <input type="checkbox"/> detachable power supply cord <input type="checkbox"/> non-detachable power supply cord <input checked="" type="checkbox"/> not directly connected to the mains
<b>Operating condition</b> .....:	<input checked="" type="checkbox"/> continuous <input type="checkbox"/> rated operating / resting time:
<b>Access location</b> .....	<input type="checkbox"/> operator accessible <input type="checkbox"/> restricted access location
<b>Over voltage category (OVC)</b> .....	<input type="checkbox"/> OVC I <input type="checkbox"/> OVC II <input type="checkbox"/> OVC III <input checked="" type="checkbox"/> OVC IV <input type="checkbox"/> other: DC supplied
<b>Mains supply tolerance (%) or absolute mains supply values</b> .....	N/A; not directly connected to the mains.
<b>Tested for IT power systems</b> .....	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
<b>IT testing, phase-phase voltage (V)</b> .....	N/A
<b>Class of equipment</b> .....	<input type="checkbox"/> Class I <input type="checkbox"/> Class II <input type="checkbox"/> Class III <input checked="" type="checkbox"/> Not classified
<b>Considered current rating of protective device as part of the building installation (A)</b> .....	N/A
<b>Pollution degree (PD)</b> .....	<input type="checkbox"/> PD 1 <input checked="" type="checkbox"/> PD 2 <input type="checkbox"/> PD 3
<b>IP protection class</b> .....	N/A
<b>Altitude during operation (m)</b> .....	≤ 2000 m
<b>Altitude of test laboratory (m)</b> .....	app. 105 m
<b>Mass of equipment (kg)</b> .....	< 18 kg

<b>Possible test case verdicts:</b>	
- test case does not apply to the test object.....:	N/A
- test object does meet the requirement.....:	P (Pass)
- test object does not meet the requirement.....:	F (Fail)
<b>Testing</b> .....:	
<b>Date of receipt of test item</b> .....	2015-07-01
<b>Date (s) of performance of tests</b> .....:	2015-07-01 – 2015-07-31
<b>General remarks:</b>	
"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report.	
Throughout this report a <input type="checkbox"/> comma / <input checked="" type="checkbox"/> point is used as the decimal separator.	

<b>Manufacturer's Declaration per sub-clause 4.2.5 of IEC60950-1:</b>	
GE Power Electronics, Inc.; 601 Shiloh Road; PLANO TX 75074; USA The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided ..... :	<input checked="" type="checkbox"/> <b>Yes</b> <input type="checkbox"/> <b>Not applicable</b>
<b>When differences exist; they shall be identified in the General product information section.</b>	
<b>Name and address of factory (ies)..... :</b>	
	TDK-Lambda American Inc. 3320 Matrix Drive, Suite 100, Richardson, Texas 75082, USA  TDK-Lambda Malaysia, PL033 Kawasan Perindustrian Senai, Locked Bag No.110, 81400 SENAI, JOHOR, Malaysia



**General product information:**

The products are component type DC/DC power modules, intended to be used as a component in an end-user's power system. These device are DC-DC power supply with open frame for building-in.

These power supplies internally generate non - SELV voltages and shall be installed in compliance with the enclosure, mounting, spacing (creepage and clearance), casualty, marking and segregation requirements of the end-use application

Schematics are included in the attachment.

The units were tested with a maximum continuous output.

These power supplies have been evaluated for use in a Pollution Degree 2 Environment.

The terminal pins have not been evaluated for field wiring.

The equipment is for building in suitable Electrical and Mechanical Fire Enclosure shall be provided.

All Models are subjected to 100% production line Electric Strength Test at minimum 2121V dc.

The hot-spot temperature shall not be exceeded as specified table page 2.

**The power supply series provides Basic insulation based on DC 40 V, between input and output.**

A. If the input meets all requirements for ELV, then the output may be considered ELV

B. If the input meets all requirements for SELV, then the output may be considered SELV

C. If the input meets all requirements for TNV-2, then the output may be considered TNV-2 requirements for TNV-2, then the output may be considered TNV-2 or SELV

**Product Overview:**

The HQA product family consists of high density DC-DC power converter modules intended to be purchased and used as a component in an end-user's power system. The input operating voltage ranges are from 9V – 40Vdc. The output voltage range will be between 3.3V and 48V depending upon the model number.

The HQA product is available in two mechanical configurations that both use the same transformer core set and output filter inductor core set except for the air gap and number of turns embedded in the pcb. The two mechanical configurations use the same pcb and part set, the difference between them is the physical size of the base plate that is mounted on the unit. One house-keeping transformer is used in HQA platform. The house keep magnetic is used to deliver the drive pulses and bias power across the isolation boundary from secondary to the primary side.

**HQA Product Family Similarities:**

The design intention is that the modules within a platform consist of a family of units with similar form, fit and function with the exception of the output voltage and current. The major differences between the modules will be as follows.

The main PWB, which houses the transformer windings, may need to be changed to modify the number of turns of the power transformer as the output voltage changes. The core material and the structure of the power transformers will remain same. The output inductor core gap and the number of turns for the output inductor may also be changed according to the output current variation, but the core material and structure will stay same.

The power semiconductor devices such as the secondary power FETs, and primary side power FETs, will be in the same physical package but with different voltage rating depending upon the specific input voltage range or output voltage and current stresses in the various power module designs. The output filter capacitors 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.

#### **HQA Family:**

The HQA product line provides a single regulated dc output voltage that is electrically isolated from the input. The HQA series power module is a roughly 2.4" x 2.2" x 0.5" encapsulated (potted) single board design that is available with through-hole I/O pins and includes a base-plate for better heat transfer. Both the power components including the power FETs, power transformers, inductors, and filtering capacitors and the control electronic circuits are located on a multi-layer FR-4 board. The over-temperature sensing device, is mounted on the PWB board. Once the temperature of the board area reaches the preset temperature, the protection circuit will shut the power module in an auto-recovery fashion. The HQA series module offers output over-current protection circuit to protect against both the overload and the short circuit. The input under-voltage is also included in HQA series module design.

#### **Isolation Transformers:**

Only two (2) transformers are used in this design. One is the main power transformer that provides primary and secondary isolation and energy transfer, and the other is a bias transformer that provides gate drive information and the on-board house-keeping power for various control circuitry and drivers.

For more detail and test results see previous Test Reports

#### **Abbreviations used in the report:**

- normal conditions	<b>N.C.</b>	- single fault conditions	<b>S.F.C</b>
- functional insulation	<b>OP</b>	- basic insulation	<b>BI</b>
- double insulation	<b>DI</b>	- supplementary insulation	<b>SI</b>
- between parts of opposite polarity	<b>BOP</b>	- reinforced insulation	<b>RI</b>

**Indicate used abbreviations (if any)**

#### **Test Report History:**

This report may consist of more than one report and is valid only with additional or previous issued reports:

Date:	VDE-Certificate:	VDE File No.:	Modifications:
(jjj-mm-dd)	CB-Ref. No.:	Test Report Number	